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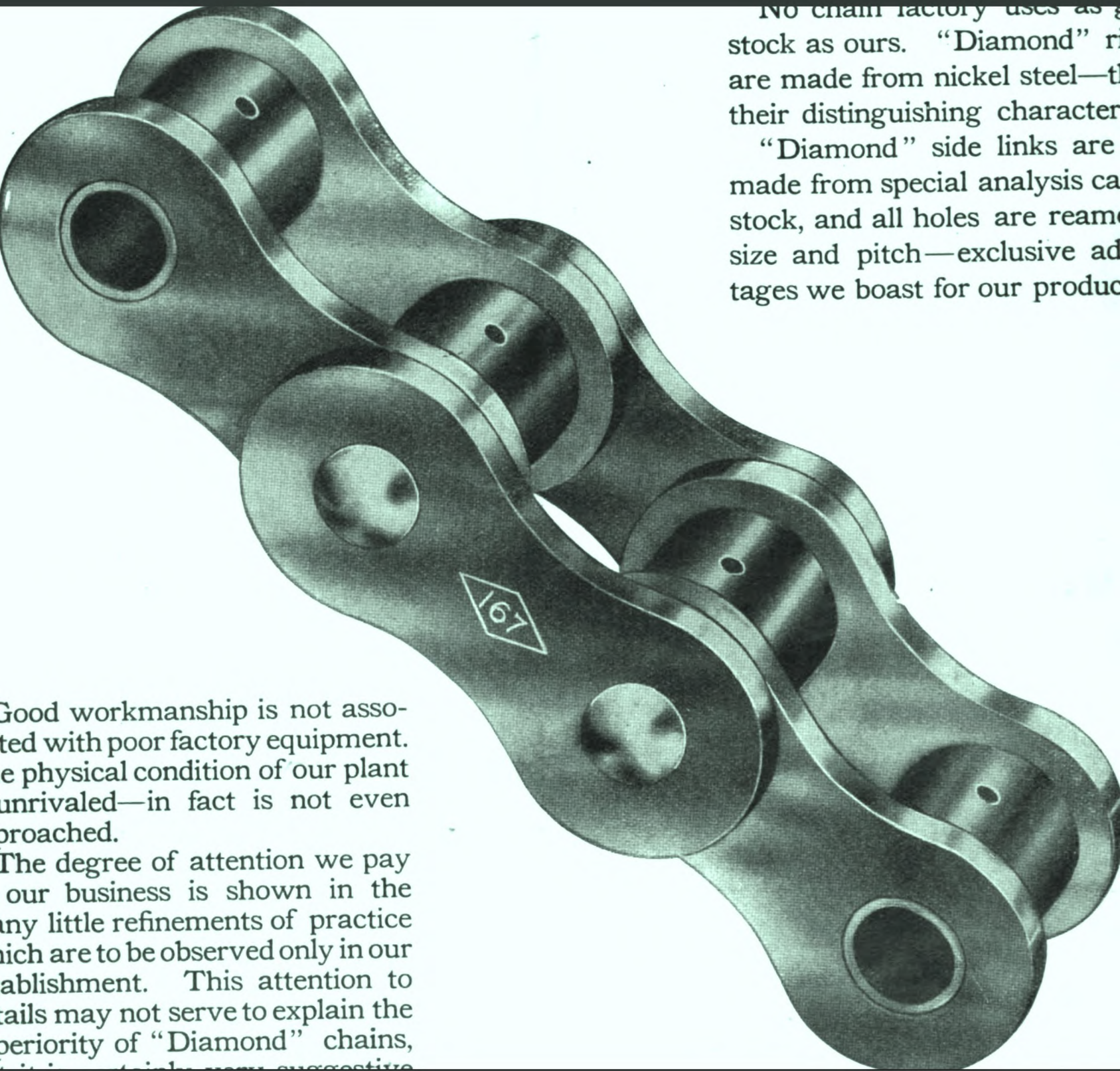

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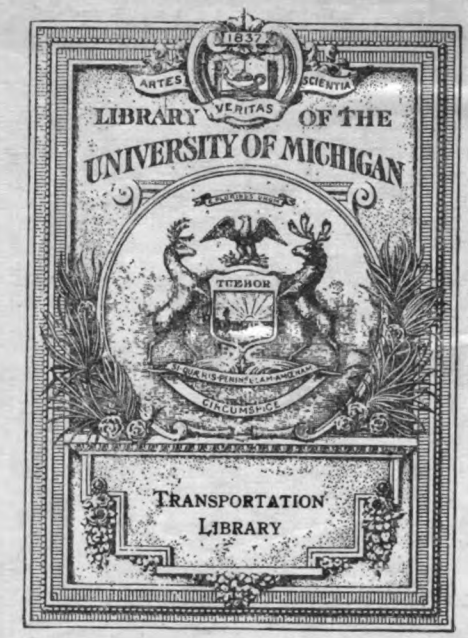

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THE POWER WAGON

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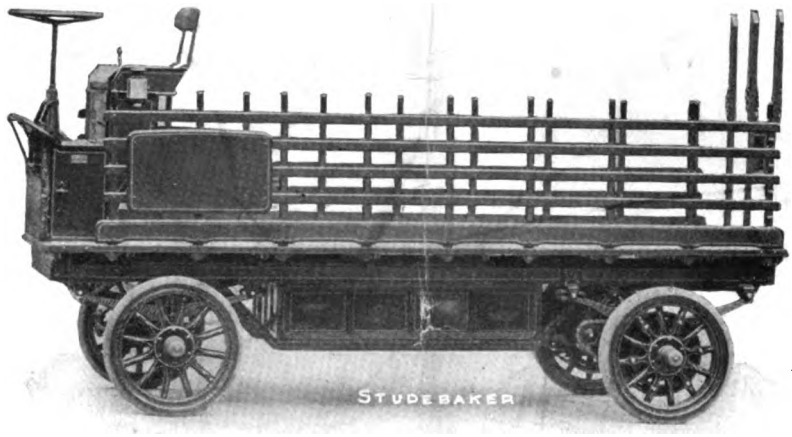

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THE POWER WAGON

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AMERICAN TRUST BLDG., CLEVELAND, OHIO

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Making Dry Facts Interesting

What We Hope to Accomplish in Subsequent Issues for The Benefit of Our Readers

WHEN this publication gets to be acquainted with its readers it will not talk about itself and its aims; neither will it talk much in generalities, however glittering. It means to become a force in the motor vehicle field by rendering service to motor vehicle users, and not by the sinister power of speaking with thousands of tongues—the capacity for doing harm.

In its short life of but little more than one week it has already been criticised as well as praised. At the Boston automobile show it was supposed by some friendly critics that the first number might be accepted as a "warning" of what was to follow: Too much essay and not enough of concrete facts. Guilty! and proud of it. But that does not mean that there will be essays or treatises in every issue.

The first number was little more than a prospectus in the dress of retrospection; a talk with those who know—wherever they are and whoever they may be, among wagon users and members of the power wagon industry—to prove in what manner *The Power Wagon* comprehends the subject it deals with. *How* it proposes to deal with it could not be shown in one, two, or three issues, but the capacity for dealing with it could be so shown. Some say now it *was* shown.

The Power Wagon desires to make friends fast and fast friends and shows its colors from the start. It deals with the means for operating motor vehicles economically and getting the maximum of work out of them. There is plenty of red blood in that subject; easily as much "human interest" as in sport, speed and touring. Wait and see!

Each succeeding issue while continuing the outline of past experience in those unavoidable terms of shadowy generality which mean so little to those who have not been cheek by jowl with the facts which the shadow-words portray, will swing more and more into practical details and graphic newspaper work.

There is no precedent for this work. Automobiles have so far been treated as an economical joke, the commercial power wagon as a rash promise—almost a fraud.

Discussion of power wagons has been of the kind which takes place in an aldermanic chamber when every vote is "fixed" and every speaker knows it.

Under the circumstances to get at the milk in the cocoanut for journalistic purposes is accompanied with practical difficulties. Those in possession of the best detail facts—some of the power wagon users—either guard them jealously or take it for granted that what a "new automobile paper" wants must be the clap-trap. There is plenty of that.

The first issues of *The Power Wagon* serve notice that clap-trap is *not* wanted, but that every fact, description or picture which may broaden or deepen human interest in, or sharpen practical comprehension of vital matters pertaining to power wagon use, *are* wanted.

Temptation to go farther has not been lacking. One reader of issue No. 1 gave expression to what it had suggested to him in a conversation, of which the substance was about as follows: "I use my touring car severely, more severely than my drivers use my four delivery wagons. You propose to assist me in operating those four wagons to the best advantage, and I should judge you could do so if you really mean to. I judge so from the first number and from our personal acquaintance. And if you succeed, I will say that we can use more delivery wagons and perhaps two trucks, *but we have enough for our present limited knowledge of how to handle them.* But there is that touring car. I don't begrudge the expense, as it gives myself and my family a good deal of satisfaction. Still, if the expense may be reduced and it could be kept in service all the time, I would like it so much better. Now, what strikes me after going through your publication, with some care, is that all the detail that lurks between the lines and which you promise to

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fetch out more sharply in coming issues, one at a time and not all bunched, in the facts and figures and pictures of somebody's experience and not in a composite word-picture of everybody's experience,—it strikes me, I say, that if all of that is good for getting better work from delivery wagons at smaller cost, it ought to be good for anybody who owns an automobile and is not fool enough to think that he gets more pleasure because it costs him more money. In other words, what the deuce is it to you what the motor vehicle is used for? I can deliver goods with a touring car if I want to, and I can pack my family into a delivery wagon (if they don't object) and go driving on Boylston street. Why limit your paper to trucks and buses and business wagons, when there are nearly a hundred thousand persons owning pleasure automobiles who could use the information to almost equal advantage?"

"We don't limit the readers," was the answer, "we only limit ourselves. An owner of an automobile who wants to operate it as systematically as a business wagon should be operated or, rather, who wants to have it cared for to best pecuniary advantage, whatever way he operates it, is of course free to take all the information from the pages of *The Power Wagon* that he can get. But, as a rule, they don't care to bother with it."

"That's where you are mistaken," came the quick reply, "the information has never been offered them, and, speaking bluntly, I think there is more doubt about your being able to furnish it than about their being willing to use it. At least fifty per cent of the mare anxious to pick up useful hints wherever they can find them—and that is at present mostly in the advertising pages—and, I should judge, at least twenty per cent of them have use for trucks or delivery wagons, too, and would be glad to place their runabouts or touring cars where they would get the same care and skill that are necessary for keeping the business wagons running economically."

Nothing in this well-meaning argument for extending *The Power Wagon's* field was quite unfamiliar, but the publishers continue to believe that the interests of power wagon users are best served at present by this publication sticking closely to its text. Those less vitally interested can better afford to get the information they may wish from a power wagon publication, than the prospective or actual users of power wagons can afford to pick their reading from pages obstructed with "automobile news," even if the latter is selected with a view to economics. The business that is subordinate to pleasure is not the simon-pure article. *The Power Wagon* will try to furnish the latter and will let the automobilists who honor its pages with their attention draw their lines of "business and pleasure mixed" where they please.

Standardization and Its Effects

IN the largest and foremost installations of power wagons much stress is laid upon the uniformity of vehicle types and equipment. The vehicle bodies are of course in most cases of varying styles and sizes, so as to be adapted for the variety of work to be done, but the power equipment and its control mechanism are standardized. The troubles obviated by standardization are mainly those relating to the help. When one driver is sick another man may be put in his place. When a repair becomes necessary the chances are that exactly the same kind of repair has been done before and that the men at the bench know exactly how to do it. Standardization promotes routine and dispatch, and routine means order, system and no mistakes, while dispatch means money. It obviates the necessity for independent thinking on the part of the help and puts them in line with the orders received. The less new thinking is necessary the fewer mistakes will be committed.

Not without reason has it been contended that the horse, whatever its economical and other shortcomings, is standardized not only in each establishment but all over the country, and that from this fact there flow many advantages not to be attained for some time in the use of power wagons.

The horse, whether big or small, requires the same kind of care. Speeds and loads vary with its size, but the traces, the reins, the bits are all operated on the same principle. When a slight departure is made, as in the adoption of mules instead of horses, such slight deviation from the standard is apt to cause some trouble with the stable help. Some of those accustomed to horses will not work with mules. How much worse must this disinclination to new work crop out in the care of motor vehicles, which differ so largely one from another?

Probably there can be little doubt that a more general standardization in power wagon construction will facilitate their introduction immensely. Much of the favor accorded electric trucks and delivery wagons is due to the fact that they practically are standardized today, and the process of standardization may be traced very largely to the predominant enterprise of one battery-making firm.

Among gasoline vehicles the types are also narrowing down to a few, but there seems to be room for speeding the process. The users of power wagons may, themselves, do much toward standardization by being extremely careful in their first choice of vehicles and afterwards sticking closely to the construction with which they and their men have become familiar, giving their repeat orders to the same firm and giving it from time to time all the benefit of their daily experience.

This publication, too, should prove a valuable aid toward standardization and the wider usefulness of power wagons which will flow from it, by disseminating all the information which users and manufacturers will impart.

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Principles and Practice In Transportation by Motor Vehicles

An Outline of What Has Been Learned by Experience with Power Wagons in America

I—The "Best" Power Wagon
II—First Cost of Equipment
III—Saving in Human Labor
IV—The Life and Durability
V—Together With Horses
VI—Training of Drivers and Others
VII—A Factor in Business Control
VIII—Tires and Other Buffers
IX—Assortment of Vehicle Sizes
X—Load Capacity Ratings
XI—High Pressure Installations
XII—Garages, Public and Private
XIII—Trucking and Express Companies
XIV—Municipal Uses and Service Stations
XV—Public Service Work
XVI—Speed Checks—Control Instruments
XVII—The Agricultural Interest
XVIII—Traction Devices—Winter Wheels
XIX—Apprentices in Shops and Stables
XX—Accounts and Their Keeping
XXI—Steam Vehicles, Now and Later
XXII—The Sociological Side

[*Sections VIII to XI in this issue—Sections XII to XXII in following numbers.*]

VIII

Tires and Other Buffers

(*Continued from March 15th*)

IT was pointed out in the portion of this article appearing in the issue of March 15 that solid and pneumatic rubber tires earn their cost by absorbing those shocks in transportation work whose main direction is lateral, toning them down before they reach wheels, engine, gears, vehicle frame, vehicle body, driver and load. The tire's capacity for absorbing the up-and-down shocks and stresses may to some extent be duplicated by other cushioning devices, especially by suitable vehicle springs—though even at this point the rubber tire offers the advantage of being always ready to receive and absorb a jolt while the benefit of springs is greatly reduced, in the frequent case of a quick succession of jolts, as from "chug holes," by their recoil or jouncing action—but no substitute has as yet been found for the rubber tire's lateral cushioning effect.

What this means in saving of wear and tear upon rolling stock is perhaps best realized by observing the violent swinging of the pole of a heavy truck proceeding over rough pavement, which sometimes throws a horse off its feet, and which is caused by lateral jolting exclusively.

The importance of lateral jolting is also illustrated in the popular favor accorded the platform type of vehicle springs. This should probably be ascribed very largely to the comparatively slight lateral cushioning which they afford through the shackling and the limited torsion of their side members. Even the semi-elliptic spring suspension gives a little more latitude in this respect than the full-elliptic, the latter throwing practically the whole brunt of lateral shocks upon the rubber tire, while in return yielding a more finely graduated cushion effect for absorbing vertical variations than any other type of vehicle springs.

[That the choice between the various types of springs is often dictated by considerations which have nothing to do with their fitness for absorbing either regular or irregular strains, but more with the height of the vehicle body, the size of wheels, etc., is another matter.]

As a really efficient sideways-buffer the rubber tire stands practically alone.

All considered, the new solid rubber tire may be superior to the pneumatic tire in this branch of usefulness, but doubtless the pneumatic tire is superior to a solid tire worn down close to the rim, and in this connection the suggestion is forced upon the mind of those who pay the bills whether the armor bands so frequently employed to protect pneumatic tires against punctures (and to secure traction) would not be economical on solid tires as well, by preserving their lateral elasticity. The undisputed difficulties of attaching armor bands to solid rubber tires may perhaps be solved if those who pay the bills consent to see the advantages which should justify the extra cost.

The suggestion, as just presented, comes from a user of power wagons and it is mentioned here as an example of one of those proposed improvements which seem highly plausible and absolutely fairminded but which are nevertheless farther from realization than first blush of thought would judge. In this particular instance the obstacle is perhaps not insuperable, consisting mainly in the fact that the chafing at the tire's attachment to the rim would wear the tire out quite as fast as without the

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armor, so that the extra cost of the latter would not be compensated for by longer life but solely by the extra protection afforded the vehicle plus a somewhat enhanced value of the rubber in the discarded tire. The proposed improvement has the rare merit, however, of nowise blocking an accurate understanding of the economical value of rubber tires, such as they are today, or interfering with their employment.

As said, the rubber tire performs what no other cushioning device in existence or in sight will do: Saving the vehicle from the natural effects of lateral racking.

On the other hand, all cushioning devices help to save the rubber tire in some form or other, and in proportion as they save tire cost they also aid the tire in its work of money making and money saving, just as one spring in carriage construction helps out another spring with which it co-operates.

All the cushioning devices or buffers in power wagons are therefore undoubtedly entitled to careful consideration by manufacturers and users. Springs, recoil-absorbers attached to the springs, brass plates under rivets, fibre or wood washers under bolt heads, flexibility in the suspension of rigid machinery units—are all allies of the rubber tires and allies of economy in power wagon maintenance.

At no other point in power wagon construction is enhancement of efficiency so beautifully entwined with cost reduction as in the interaction between tires and other buffer devices. The necessity for such interaction is specific for power wagons.

It is worth cultivating; cultivating with a view to ultimately reducing the maintenance cost of power wagons to the level of normal maintenance cost for stationary machinery of similar construction.

A very interesting step toward this theoretical ideal is embodied in the various anti-shock devices designed to be attached to vehicle springs to deaden the jounce. Their American development has departed from the original Truffault friction device which is simple and clever—being not nearly as irrational as it looks—in favor of hydraulic or pneumatic checks upon the spring rebounce. No more practical way of grafting experimental pneumatic suspension upon the established spring suspensions could be imagined. Eventually it may lead to more fully developed forms of air cushions by which tires may be relieved of their hardest work—laterally as well as vertically—and their life prolonged.

It is the speed and value of power wagons which renders the cushioning vastly more important than in ordinary vehicles. The loaded power truck going twice as fast as the loaded truck drawn by horses receives in a given time of travel twice as many shocks each of twice the intensity. The time for recovery of the equilibrium of the cushioning devices between shocks is reduced to one half. The same consideration holds true, of course, in a comparison between power wagons operated at different speeds.

Taking number and intensity of shocks as the measure of the severity of service, the truck traveling six miles per hour receives a treatment four times as severe as a truck traveling only three miles per hour, if the weights and loads and roads are equal.

The economical dangers involved in overspeeding particularly with overloads, must be evident, but a certain degree of speed is essential for profits, and there is a reasonable limit for the dead weight and brute strength in vehicle construction.

The tires and other buffers must bridge the alternative, must render it possible to save at the spigot of speed-advantages and at the same time prevent wasting at the bunghole of maintenance cost. It would be difficult to overrate the importance of this function.

IX

Assortment of Vehicle Sizes

ALL owners of transportation plants are familiar with the ever-recurring question of vehicle sizes. It bobs up every time a new wagon must be purchased. Theory invariably pushes for large size and capacity, and minor practical necessities invariably cut the theory in two. The struggle is between the ton and the mile, with "first cost," "fixed charges," "empty returns," "loading time," and a swarm of varying business considerations holding the balance of power. If the theorist were in the habit of according the proper money value to speed, he would not be so sure that large sizes were preferable, but the proper estimate of the speed value is only coming slowly to its rights with the advent of the power wagon. Every thought relative to first cost and fixed charges, if drawn from experience with horse-and-wagon service, will need to be remodeled. To decide whether two 1½ ton or 2 ton power wagons of 6 to 8 miles average speed may be bought and operated at a cost and a profit comparing favorably with the cost and profit from purchase and operation of one 3 or 4 ton truck of 5 miles average speed, is no child's play, and it would be futile to contend that any data have been gathered by power wagon users which would assist others in reaching the best possible decision. The difference in speed should certainly always be carefully considered in the estimate.

A complete survey of individual business conditions and a searching examination of what the power wagon industry offers in the way of prices, sizes and guarantees, seem to be required in each case.

And here is where the expert should step in with a helping hand and an unbiased mind, versed no less in the horse-and-wagon system than in the ins and outs of power wagons. Without familiarity with the best in the past it would be difficult for him to recognize the requirements of the present and of the future.

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Unfortunately, available experts are few and far between.

One guiding fact is noted, however. There is a distinct tendency toward employing power trucks of smaller load capacity than that of the horse-drawn trucks previously employed in the same business. Repeat orders from power wagon users also tend toward smaller sizes. This tendency seems so much more remarkable as the speed of power trucks does not decrease so rapidly with increasing weight and load as the speed of the horse-drawn truck.

Apparently it has been found by experience that certain relations exist between routes, distances from headquarters, practicable speeds, loading time, working hours, price of vehicles, maintenance cost and the need of reserve vehicles for emergencies or rush work, which—all comprised in one difficult mental grasp of a situation—argue for vehicles of capacities from 1 to 3 tons rather than for the larger sizes, unless the business requirements leave no doubt in regard to the regular daily need of vehicles carrying 4 or 5 tons or even larger loads.

There seems to be room for suspicion, however, that this empiric finding in favor of the smaller sizes may be less universally valid than the unanimity of the American records would make one believe. From England, France and Germany come reports favoring 6, 7, 8, and 10-ton vehicles, usually steam trucks operated with or without trailers. Perhaps average road conditions in this country affect the size of vehicles more than all the other factors combined, and perhaps the limitations imposed by these *average* road conditions have affected the industry to such a degree that the opportunities for obtaining the largest sizes of power wagons have been contracted.

Rash inferences from the fragmentary experience at disposal are plainly unjustifiable in the maze of considerations that bear upon the subject. Those who have work for power wagons over roads of known and permanent quality, permitting a relatively high speed for the heaviest loads with power wagons (while not permitting any similar increase in the speed of horses), and who naturally would desire the largest load capacities obtainable, should probably not be deterred from securing the sizes intrinsically best adapted for their work.

This is mere reasoning. Readers of this publication, consisting mainly of principals in mercantile establishments of some magnitude, are fully capable of doing their own, when the *new* material needed for completing the reasoning process is furnished.

All such material, really on record and available and bearing on sizes of power wagons, is believed to have been given or implied in the foregoing brief remarks. To apply it to the questions which arise for each user of power wagons with regard to the best *assortment* of vehicle sizes in a large installation and with additional regard to the bulk capacity of the vehicles, must be left to the judgment of him who in each case knows the needs of the business to be served.

Examples from power wagon practice during the past few years might be instructive if available in complete, definite facts and figures. But they are not so, pointing only vaguely to a certain danger of having bulk capacity abused by overloading and to a certain advantage in supplementing an installation of heavy electric trucks with gasoline vehicles of smaller capacity and greater speed.

X

Load Capacity Ratings

SO as to be more easily understood by its customers the power wagon industry has sold its vehicles with the load capacity ratings expressed in the same terms and on the same scale as are used in the classification of ordinary wagons.

The result seems to have been a misunderstanding. The industry was too accommodatng in attempting what could not be done, and the users took for granted that it could be done.

Broken springs, sprung axles, twisted frames, wrenched tire attachments, rapid wear of misaligned bearings, burned out armatures and probably several other troubles have attested the misunderstanding which sprang from a desire to be understood. They have also removed the misunderstanding, but at an unnecessary cost and not quite generally. There are still many who assume that a 1-ton electric or gasoline truck may be loaded with 2 or 3 tons occasionally without harm, just as a 1-ton single-horse truck may be loaded with 2 or 3 tons occasionally if the horse can pull the load.

As a matter of fact the power trucks and delivery wagons have been built with fully as high a "factor of safety," or surplus carrying capacity beyond their rating, as horse-drawn vehicles of the same rating. When standing still they would support their overload without creaking, squeaking or yielding abnormally at any point in their construction. They would continue to bear up at horse speeds. That justified the rating and the Pickwickian sense in which it was accepted, meaning as much more as could be conveniently piled into or onto a wagon of the particular class and description referred to in each case.

In practice, however, the power trucks and delivery wagons were not limited to horse speeds, but were driven much faster, whether overloaded or not. As pointed out in another section (Section VIII) double speed means shocks and strains of at least double intensity and twice as many of them in a given time. The rating had not been formulated with these quadrupled strains in mind. The "factor of safety" and the tires did not always take care of them, fully.

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The horse is to a certain extent automatically checked by an overload. What its nature fails to provide—when going down-hill, for example—the driver accustomed to his work does for it. The speed that "goes" with the load capacity rating of the vehicle "goes" without saying.

With power wagons there is no similar automatic speed check. Under a number of different circumstances they can be driven very fast with a large overload, and a horse-vehicle load rating without accompanying speed limitation is therefore misleading.

One or two manufacturers of power wagons have discarded the horse-vehicle rating system and adopted instead the railway system of rating each vehicle according to the maximum load. Their ratings are nominally higher, but their customers are supposed to understand that overloads are not admissible. It is doubtful whether they also stop to consider that the railway companies can afford to neglect the speed factor, or at least need only consider it summarily, because the smoothness of rails and the comparative insignificance of gradients greatly reduce the range of stresses to which their rolling stock may be subjected. If the maximum rating system for power wagons is practically based on static load in the same manner as in the rating of railway freight cars, it does not seem to offer any much greater guarantee against misunderstanding and abuse than the common system or lack of system inherited from horse-and-wagon service. The power wagon user is in both cases thrown back upon his own and his drivers' discretion.

A conscientious driver will consider load, speed and road conditions, all in one, and the best rating system is the one that starts with cultivating the driver's judgment and self-control.

XI

High Pressure Installations

KEEP the motors hot, the batteries charged and discharging!

An idea which was bound to come to the surface sooner or later has already dawned upon the delighted vision of a few managers of road transportation systems who are well advanced in the art of energetic and economical maintenance of power wagons.

The leading thought is simplicity itself. Only this: Use your power wagons all the time, day and night, and at the maximum speed consistent with traffic regulations. Have your machine shop and your expert repair men at your garage instead of at the factory where the wagons were made. Foresee all possible troubles. Never delay repairs or replacements. Work day-and-night shifts of drivers and garage help. Standardize your vehicle equipment. Do the work of ten power wagons with four or five. Vary the nature of the work, if by no other means you can expand the volume. Haul dirt, stones or brick at night, if necessary, and passengers or merchandise in the daytime, as some of the trolley lines do.

* * * *

Patiently the power wagon submits to this treatment and even promises to thrive by the change. Now, finally, it is sure of careful attention.

The idea has the same charm as high-pressure dairying, cattle feeding and agriculture with their manifold expenses for machinery, ice, stable buildings and oil cakes, costly manure, hot water pipes, tiles, glass rooves, etc. The expense is much higher, but so are the receipts.

In the present instance the crop is transportation.

* * * *

It is not for a moment supposed that all power wagon users can, or should try to employ high-pressure transportation methods, but these methods are among the new means placed at disposal by the power wagon for rapid expansion of an express or trucking business, almost independently of the limitations of space and location which handicap many a growing concern. With the aid of high-pressure power-wagon methods pure energy will be able to provide for expansion of business volume in a manner never before dangled before the dazzled eyes of the transportation-business manager of bounding ambition.

The saving in capital investment, the saving in rolling stock, space and rentals comprise not all the inducements on the economy side. Neither is the hope of rapid business expansion the whole inducement on the profit side. By using few vehicles and using them at a pace that would kill anything but a repairable organization of steel units in double quick order, the owner hopes to pay for the vehicles as well as for their strenuous maintenance practically out of his business profits and he figures that by wearing the vehicles out rapidly he will be in a position to take advantage of all progress in construction without being obliged to discard serviceable rolling stock.

Probably there is not a single concern in this country which has reached to a deliberate high-pressure system, but there are many which under high pressure have used their power wagons extravagantly and have recognized that such use carried its own punishment with it, unless a high-pressure maintenance system were at the same time adopted. To install a high-pressure maintenance system has, so far as known, in all cases proved a difficult matter, for the reason that it was not contemplated to continue the extravagant high-pressure use of the vehicles beyond the rush season, and the incentive for doing the thing systematically was therefore lacking. The experience was commonly that of a hustling department store.

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Acknowledgement of the possibilities has not come from their full realization in any one place but by piecing together bits and fragments from everywhere. Nevertheless, the sentiment created has been strong enough to carry conviction in some quarters not only of the necessity of high-pressure maintenance with high-pressure use but of special virtue and economy in such high-pressure mantenance, arising presumably from the tendency of a strong system to gather strong men, capable of putting better as well as more work into the maintenance.

In England where power omnibuses are operated with so much success that the industry is not able to supply the demand, the omnibus companies have been forced to keep the limited number of vehicles at their disposal in constant commission, in some cases including all night service, and one of two things happened. Either they succeeded in keeping the vehicles going by organizing the maintenance on the high-pressure plan, or they failed in the latter and the service was crippled and, if the financial resources were not equal to providing new vehicles to take the place of the percentage in the repair shop, or none could be had for love or money, the companies went to the wall. These British conditions in the field of public service vehicles embody probably the best schooling for high-pressure power-wagon employment, and the results accomplished in some cases—according to the British power wagon journals—go far to prove that "there is money in it" if it is done right, even if the origin of the system was sheer necessity.

Without being able to define all that a high-pressure transportation system would involve, but merely to point out that a movement toward such a system is clearly discernible here and there and at present working out its own salvation by the cut-and-try method, *The Power Wagon* deems it advisable to draw attention to the interesting possibilities, more particularly in view of the shortage in the supply of power trucks, stages and omnibuses which very probably will be experienced in this country within a year or two, or earlier.

Is Alcohol a Coming Fuel?

MANY industries are following with lively interest the bill at present before Congress providing for the removal of the internal revenue tax from grain alcohol employed for industrial purposes. They are interested because grain alcohol is either absolutely necessary for some of their manufacturing processes, and they don't like to pay a tax of $2.08 on every gallon of pure alcohol they are compelled to use; or it is preferable to wood alcohol, on which there is no tax, but for which they are nevertheless compelled to pay 70 to 80 cents per gallon and even higher, according to the grade of refinement required, because the makers of wood alcohol take advantage of the tax on grain alcohol to charge what they please. If the bill of repeal is passed, grain alcohol will be obtainable for 10 to 20 cents per gallon.

There is something to fight for, and the true fathers of the bill, the "Committee of Manufacturers" with headquarters in New York City, have been doing their utmost for several years to marshal all their natural friends in battle order so as to down the strong lobbying forces of the wood alcohol kept constantly on guard in Washington for the specific purpose of warding off any and all legislation for the repeal or reduction of the tax on grain alcohol.

Through the agitation in favor of the bill, however, an impression has been somewhat generally created that alcohol really might furnish an acceptable substitute for the fuels now used if the motors were changed in some minor details, and many have even been induced to believe that it would be worth while to wait for this development before tying up with gasoline motors or electric traction.

Developments in Germany and France seemed on the surface to indicate a superior economy in the use of grain alcohol mixed with benzol or with wood alcohol, but it was usually overlooked that the economy when really effected was limited strictly to stationary motors of slow speed and working at constant power development, without throttling, and also that whatever economy was attained depended upon the much higher prices of gasoline and kerosene prevailing in Europe.

While the motor vehicle industry can well afford to congratulate those other industries which are really interested in the proposed measure for rendering the grain acohol available for industrial purposes, it can scarcely afford to overlook the fact that technical difficulties in employing alcohol for motors required to work over a wide range of power development are much more serious than represented and cannot be expected to be removed for a very long time to come.

The low thermal efficiency of alcohol renders necessary a very high compression of the gaseous charge in the cylinders—no less than 140 pounds—before economy can be realized and before ignition can be made reliable.

With the bill in its present form proposing that the "denaturing" of the alcohol shall be done with wood acohol, it is also to be remembered that wood acohol has been demonstrated in Germany, France, Austria and Russia to be of all "denaturing" agents the one least adapted for internal-combustion engines.

The Russian government has a standing offer of a $50,000 prize for the devising of a suitable "denaturant," assuming that wood alcohol is not such an agent. In Germany the "denaturant" always used in practice is gasoline or benzol, and in France the use of alcohol has practically been abandoned even for stationary motors.

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Care of Electric Vehicles

A Simple Study of a Great Many Matters Vital to Their Proper Maintenance

IN too many instances the maintenance of electric vehicles is surrounded with a false air of mystery, for the existence of which there is absolutely no reason.

Proof is not lacking to establish that wherever a properly designed electric automobile, with an adequately powered battery, has been put to the service for which it was intended, it fulfilled to the limit every requirement expected. Of course, it has had to be treated with that qualified attention which might reasonably be accorded to any mechanical contrivance, and without which it cannot survive. No beast of burden ever served its operator more faithfully, or responded more readily to fair treatment.

It is, however, perhaps its own worst enemy, inasmuch as the limit to which it may be abused without permanent injury is exceedingly great. As in other good things, this limit is frequently reached and exceeded, and then the ignorant authors of such abuse are loudest in their frantic ravings against its collapse.

"SCIENTIFIC" EDUCATION NOT REQUIRED

It is a delusion to assume that anything in the nature of a scientific education is necessary to the proper care of an electric vehicle. But it does call for a reasonable amount of everyday common sense, a little special information as to what to do and when to do it, and the faculty for doing that "it" just as often as required. With this equipment any healthy male or female can compete with a college professor, but without it you might as well intrust a lunatic with a locomotive.

Small and simple as is this practical information, its dissemination has been a rather slow and gradual process. The usual kind of it is generally filtered through such a maze of mathematical fog and profound chemical deduction as to confuse and bewilder.

STUDYING THE VARIOUS PARTS

The problem of properly caring for an electric automobile involves not so much a knowledge of the history of its development or the theory of its electric and chemical functions, as a personal acquaintance with the detail parts and how to keep them in working condition. If you can acquire this knowledge you have solved the problem for yourself, the complexion of the whole proposition changes, and its simplicity becomes evident. This experience will be a source of pleasure and profit, whether you own a delivery wagon or truck. It matters not whether the machine is cared for by yourself, your employes, or at a public garage. There is this moral obligation involved in the ownership of a machine, both in justice to it and yourself—you should be qualified to care for the interests of both.

KNOWLEDGE WHICH MUST BE ACQUIRED

Begin by resolving the whole machine into its various elements, studying the part which each plays in the harmony of the whole. Observe the mechanical details and the special features of construction. Remember that each part has been thought out separately, designed and re-designed perhaps a dozen times before all the little obstacles were overcome and the present state of mechanical perfection attained. Note the peculiarity of the steering device and its difference from that of a horse-drawn vehicle. Think out the reason for this construction. Examine the nature of the wheel bearings and the bearings of the other moving parts. See what provision there is for adjustment when wear takes place. Look at the various connecting rods and the kind of ends they have, how their length is altered and for what purpose, the provisions, if any, for taking up wear, and the method of lubrication.

There is nothing extraordinary about the care to be given to these parts. They should be cared for, watched and oiled, with the fact ever in the mind that they are vital to the whole mechanism, and that while this part of the machine is subjected to the most violent usage it is often the most neglected. This is how errors creep in. The simple parts are overlooked. Friction or looseness in any of these parts means increased cost of operation and depreciation of the machine.

THE METHOD OF TRANSMITTING POWER

Now look at the method of transmitting the power to the wheels, the various details of this transmission, the speed reduction, if you are sufficiently interested, the method of adjustment in case of wear, the provision for lubrication, and the plan for removal in case of necessity. Next study the brakes, their design and method of action, all the small parts about them which require oiling to insure prompt and perfect action. This is worth being sure of, as its importance is vital and its use frequent and severe.

NOTHING FORMIDABLE ABOUT THE MOTOR

We are now up to the motor. To the uninitiated it constitutes the first formidable feature, although practically there is nothing formidable about it. It is simplicity itself, and consists of two magnets, one stationary and the other revolving in the center of it. The wire is wound around these magnets in a peculiar way. But don't bother about that, or the lines of force and such things, as they relate to the design and theory, in which we are not interested at present. What we want is to be able to keep things moving properly.

SOURCE OF THE VEHICLE'S ENERGY

The current which operates the motor comes from the battery, and as it must of necessity enter the wire on the moving magnet, or armature, the cylindrical copper device, or commutator, at one end of it serves for this purpose. To the ends of the wire leading from the battery are attached pieces of carbon, called brushes, which rest upon

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the revolving commutator and thus convey the current to the moving wire-wound armature. It is important that proper contact is insured between the brushes and the commutator at all times, and as these brushes will wear down they will require occasional renewal.

The bearings on the motor will call for the same attention as the other bearings of the machine. The wire terminals and other details of the motor should be kept tight and dry, and separate. Like all other electric apparatus with which we are familiar in daily life, it really requires very little attention, but being located under a wagon and exposed to all kinds of severity, it is but reasonable to give it a trifle more attention and consideration than the fan in your office.

The wiring about the machine is not usually exposed, but wherever it is all that is necessary is to keep it dry and clean and where possible, particularly in the vicinity of the battery, keep each wire separate from the others.

SIMPLICITY OF THE CONTROLLER

The controller at first sight may seem a very complicated device, but a little familiarity with it simplifies it marvelously. It is nothing more than a switching arrangement for connecting the battery to the motor in various ways, so that the speed or direction of the motor can be changed. All wires from the battery and the motor are led to it, and are each connected to brass strips or fingers resting on a rotating drum. This rotating drum has a number of inter-connected contacts, on which the fingers rest, and by means of which they are connected with one another in various combinations. It is essential that the pressure between the fingers and these contacts be sufficient to insure good connection of the surfaces. The controller does not often get out of order, unless abused or entirely neglected, but the damage done under such circumstances may be disastrous to the whole apparatus.

It is interesting to study out the wire connections. The manufacturer of the motor is usually willing to furnish a diagram for any particular vehicle. The benefit of such information is felt when locating electrical troubles, as the controller, being the center of distribution, is the keyboard to the whole electrical equipment.

DEVICES OF MUCH CONSEQUENCE

The lighting and signaling devices are perhaps regarded as most insignificant when not in use, but in emergency they are of much consequence. Do not neglect them. They are usually of such fragile and flimsy construction as to persistently baffle honest effort to keep them straight. But don't give up, as with a little ingenuity you can make and keep them permanently right.

The charging receptacle must be kept clean and in such condition that when the plug from the charging apparatus is inserted in it the connection established will be a wholesome one. Maintain the receptacle securely fastened to the vehicle, so that there is nothing loose or rickety about it. Be sure it is protected from being wet either by rain or in washing. When not in use for charging a suitable cover should protect it against accidental connection between its terminals. Trouble of this nature might cause the loss of the battery or the burning of the machine, as the whole power of the battery is on tap at this receptacle except when it is disconnected by means of a switch.

IMPORTANCE OF THE METERS

Now about the meter or meters with which nearly all vehicles are equipped. They are of extraordinary importance, as they are the coupling links between your intelligence and the inside workings of the electrical equipment. It is important that they should be "right" in the same sense as that term is applied to your watch. But don't worry too much about the ancestry or theory of volts and amperes. Just remember that one signifies the quality and the other the quantity of the power going in or out of the battery. They exercise certain influences upon one another, but this you will understand when you get better acquainted.

Of course, you may be "on" to all of the foregoing, and may smile at its ridiculous simplicity, but if you had any conception of the multitude of owners and operators who are "off" you would start with astonishment. The purpose of this article is to endeavor to dispel some little of the haze and brain-fog, which is notoriously prevalent, on the subject of hand power as applied to the electrical automobile. It is a few straight, plain words from overalls, rather than a hypothetical disquisition in broadcloth.

TREATMENT OF THE STORAGE BATTERY

A thoroughly practical knowledge of the proper treatment of a storage battery is essential to the successful operation of an electric automobile. To obtain this knowledge is not nearly so difficult as is generally supposed. Anyone who will seriously make up his mind to master it will find the problem comparatively simple. A few years ago there was much diversity of opinion as to the proper treatment of vehicle storage batteries. The pressure which business necessity brought to bear on the development of successful practical methods has brushed aside many of the fancy theories previously in existence, and established hard and fast common sense practices which, if adhered to, are certain to produce positive results.

NO MYSTERY ABOUT THE BATTERY

The storage battery as seen through text books appears decidedly complicated, but when resolved into the component parts of each cell there is nothing more mysterious about it than some lead plates immersed in a solution of acid and water.

In order to examine the elements of which the battery is composed it is necessary to be able to get at them with ease. The construction of the vehicle has much to do with the means necessary to accomplish this. If possible the battery should be withdrawn from the vehicle and placed on supports in such a manner that you can walk all around them, and reach without difficulty any particular cell. The battery is no more complex than a single cell,

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which consists of a hard rubber jar containing two groups of lead plates immersed in water and a small proportion of sulphuric acid. These two groups of plates are practically alike. They are made of lead. But the chemical nature of the active material on the plates is somewhat different. By the act of charging, or putting current into the cell, the nature of the active material is changed, and by the action of discharging the cell, or withdrawing the current from it, the active material is converted back into its original state.

RESEMBLANCE OF HORSES TO BATTERIES

There is a somewhat peculiar resemblance, strange as it may seem, between a horse and a storage battery. If one who has been familiar with the care and management of the former were to study its comparison to the latter, he might more readily become familiar with that method of handling the battery which would tend to make it as serviceable, if not more so, than his older acquaintance. The process which goes on in the charge and discharge of a battery is no more difficult to comprehend than the action which goes on every day in resting and working a horse. A certain amount of energy is put into his system by feed and sleep. If the quantity of each is sufficient the process which goes on is invigorating and refreshing, and when called upon to work, after this sleeping or charging period, he is full of life and energy. His potential, or voltage, is keyed up to the top notch, and he is ready and willing to perform any reasonable service called for. If forced during the first few hours of labor fatigue will set in prematurely, and his working efficiency, or the possible labor which he might render, is very low. If, on the other hand, the work is so proportioned that an honest and reasonable day's labor is performed, the period of fatigue will not set in until the day's service is completed, and the period of rest and recuperation may follow in natural sequence as before. This procedure is identical with a battery.

FURTHER RESEMBLANCE OF HORSES TO BATTERIES

The storage battery is an inanimate horse in many other ways. The grid, or frame, may be compared to the frame or skeleton in the other. Not much trouble will occur from either, except in the accident of fracture. The active material of the battery plate, which is compressed into the frame, is similar to the flesh of the horse's frame, and each should be plentiful, firm and healthy to get the best results. Defects in one case will very closely resemble defects in the other. *The theory of the process which goes on in the refreshment and fatigue of horseflesh is as difficult for the layman to understand as the nature of the chemical change in the active material on a battery plate; but there is in reality no more reason to be concerned about the one than about the other. All that is necessary is to know and perform that method of treatment which in everyday hard service will produce the results desired.*

Before dropping similarities it may be well to observe that in the same manner as a good deal can be learned about the physical state of the animal by knowing something of the condition of his blood, you can likewise tell just as much about the battery by examining the state of the liquid in it. The indications are about the same in each case. It is essential that at least the temperature of each should be kept within the same limits.

INTELLIGENT CARE OF BATTERIES

It will be evident, therefore, that the care of a storage battery does not call for any more intelligence than that required for horseflesh, but the same ever vigilant attention, together with an equal amount of practical knowledge, is necessary to assure the continued working efficiency of a battery equipment. The one difference being that the results obtained in the latter will be far more definite, reliable and encouraging.

Just as a large stable of horses can be supervised by one intelligent, practical manager, so also can a large battery equipment be handled by a single competent workman. But he must be a competent workman in all the meaning of the term, and have enough of the qualifications of a manager to insist on the co-operation of his subordinates who actually operate the batteries on the street.

THE CARE OF THE BATTERY CELLS

As has been stated, a battery, or in fact a whole equipment of batteries, is no more complicated than a single cell; and, therefore, it will be apparent that if we master the peculiarities of one cell we have control of the entire situation. The care of every single cell, however, is of vital importance, as each one forms a link in the entire chain.

It will be noted that the plates in a cell are divided into two groups, which practically means that there are but two plates there. Instead of having two very large single plates it is found much more feasible to arrange them in the compact method adopted. The size of the area of the plate surface in each cell determines the amount of work the cell, or in fact the entire battery, will perform, since each cell bears the same relation to the entire battery that a single link bears to a chain. Hence a cell may be a nine-plate or a nineteen-plate cell, depending on the work required of it, the battery being proportioned to the load it has to draw, just as a horse is selected by weight, according to the tonnage of the wagon to which he is to be attached.

SOME NECESSARY PRECAUTIONS

It will be seen that precaution is taken to keep one set of plates separate from the other, and yet the space between them is as little as possible, while the separators are so designed as to permit the free escape of gas which is given off in the process of charging. It is essential that no metallic material should be permitted to bridge across from one set of plates to the other, whether through broken separators or at the bottom of the cell, where such loose material will collect as may disintegrate from the plates.

All of the working surface of the plates should be covered by the liquid, or electrolyte, because this is the medium by which the functions going on in the cell are

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transacted, whether in the process of charging or discharging. This electrolyte consists of pure water with a percentage of sulphuric acid added to it. The way to find out if it has the right amount of acid is to take a small quantity of the liquid and float a hydrometer in it. If the surface of the liquid reaches that point on the scale marked 1.300 the specific gravity is correct, provided the sample has been taken from the cell when it is fully charged and the temperature is about 75 degrees F. When the cell is discharged the strength of the solution will be considerably weakened, due to the union of its constituent parts with the active material of the plates. There is a very convenient device sold by battery manufacturers, by which a portion of the liquid can be taken from a cell, measured and returned in a few seconds, without any inconvenience to the manipulator.

APPEARANCE OF PLATES WHEN CHARGED

When the cell is charged the positive plates will assume a rich chocolate color, and the negative plates a bluish slate color. The liquid will then have a rich limpid appearance, and the voltage of the cell when disconnected from the charging circuit will read 2.1 volts. When the cell is discharged down to its safe minimum limit its voltage will read 1.8 volts; the positive plates will then have assumed a grey color, and the negative plates a somewhat lighter grey, approaching white. The liquid will appear thin, and resemble water more so than before.

Every size cell has a definite capacity, depending on its area of plate surface, and this capacity is generally stated in the amount of current it will furnish per hour, in discharging for four hours. Thus a cell having nine plates 5¾x5⅝ inches will have the capacity to furnish 28 amperes per hour for four hours, or 112 ampere-hours in all. Twenty-eight amperes will be the most advantageous rate at which to discharge this cell, although it may be discharged at a higher rate with less efficiency.

THE PROPER CHARGING RATE

The proper charging rate for any size cell will be three-quarters of its normal discharge rate, which in the example just mentioned would be 21 amperes. The time required for recharging will necessarily be longer than the time occupied in discharging, since there is a loss in this conversion of energy from one state to another. When the cell or battery is placed on charge we then have the voltage to guide us as to when it will be brought back to its original state of charge.

THE CHARGING OF A BATTERY

In providing for the charging of an ordinary lead storage battery the first requisite is to have a source of direct current, with a voltage of at least 2.75 volts per cell of battery to be charged.

The reason for this is that the charging current may have a voltage ten per cent higher than each cell will have when it reaches its maximum voltage of 2.5 volts on charge, so as to be able to force current into the cell against the opposition of its own voltage, which tends to resist or counteract this effect on the part of the charging circuit.

To avoid confusion with regard to the various voltages of the storage batery cell, it must be understood that when the cell is connected to the charging circuit its voltage will be higher than when it is disconnected from that circuit, the normal voltage of a charged cell disconnected from the charging circuit being 2.1 volts. Furthermore, when the cell is connected to the working circuit, and supplying current thereto, its voltage will be lowered by the stress put upon it in the abstraction of current, and if this stress is maintained long enough to fully discharge the cell to its safe minimum the voltage will drop to 1.8 volts. Then the charging process must be immediately commenced in order to avoid injurious chemical action taking effect on the cell in its weakened condition.

COMMERCIAL LIGHTING AND POWER CIRCUITS

The commercial lighting and power circuits used for charging generally have a voltage in excess of that required for ordinary batteries, but the nearer the voltage is to that required by the batery the more economical will be the consumption of the power from the charging circuit.

To properly regulate this voltage, and govern the amount of current put into the battery, the charging circuit must be provided with a variable resistance or rheostat which will permit more or less current to pass into the battery. This rheostat resembles a valve in an ordinary water or steam pipe, as far as regulating the supply is concerned, but there is a certain amount of power absorbed or converted into heat in the rheostat, depending on the function which it performs in reducing more or less current from a higher to the required voltage.

VOLTMETERS AND CIRCUIT BREAKERS

For measuring purposes a voltmeter must be connected to the two terminals of the battery and an ampere meter inserted in one side of the charging circuit, preferably between the battery and the rheostat.

A very desirable device which is coming into general use is an overcharging circuit-breaker, which will automatically disconnect the battery from the charging circuit just as soon as the voltage of the battery reaches a predetermined point. The value of this circuit-breaker becomes very pronounced where a number of batteries are to be charged simultaneously and where individual or constant atention cannot be given to each batery while on charge. It is a faithful sentinel which guards against the principal cause of battery deterioration, the too frequent overcharging of the battery.

SOME OTHER DESIRABLE INSTRUMENTS

Desirable adjuncts to a charging outfit are a thermometer and a hydrometer, although in many cases, paricularly where the battery is charged while in the vehicle, it is not always feasible to take advantage of their use. Where they can be frequently used to gauge the temperature and specific gravity of the electrolyte, or liquid in the battery, their services will nave a marked effect on the maintenance of proper charging conditions.

(To be Continued)

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Wagons In The Market

Design Features of Commercial Interest in Gasoline, Electric and Steam Vehicles

WITH the purpose of presenting to prospective users of power wagons a ready means for looking over the opportunities which the manufacturing industry offers for meeting their wants, *The Power Wagon* of March 15—the first number—published an illustrated summary of the various chassis and vehicle styles made by twenty manufacturers. Those features in design relating to power, load capacity, bulk capacity, tire dimensions, springs, power transmission system and lubrication, were noted, as well as other special features bespeaking adaptation to special forms of work. The nicer points in mechanical construction, which may be correctly appreciated only by lengthy detail explanation and close study coupled with knowledge of materials and workmanship, were as a rule omitted. Visits to factories and practical tests will be found of greater real value for a layman's study of mechanics than any exposition of construction in mere lines and words.

The summary is continued in the following and will be concluded as soon as photographs for reproduction shall have been received from the very few remaining manufacturing concerns who cater to the power wagon users' wants.

* *

The Rapid Motor Vehicle Company of Pontiac, Mich., manufactures commercial vehicles of 1 1-2 tons capacity which may be divided into five classes, namely, closed-top delivery wagons, express-top delivery wagons with open sides and protected by wire screening, open business wagons, platform stake trucks and passenger or sight-seeing buses with canopy top. Each of these styles of wagon bodies is made in two sizes, and the chassis are of two different dimensions, one rated to carry one ton and the other 1 1-2 tons, but otherwise similar in design. The motive power is furnished from a horizontal 2-cylinder motor mounted lengthwise on the left side of the chassis with a crank shaft extending to the right and carrying the planetary change-gear set. The drive from the gear is by single chain to a countershaft, and thence by side chains to the rear wheels. The cylinders are of 5 inch bore by 5 inch stroke and each cast in one piece with the cylinder head, the water jacket and the valve ports. The ignition is by jump spark from a single coil with distributor to the 2 cylinders. The planetary transmission has 2 forward speeds and reverse. The frame of the vehicle is of angle-section steel. The wheel base is 90 inches. The springs are of the platform pattern both rear and front, and the wheels are 32 inches in diameter and shod with 3 inch solid rubber tires.

The Rapid company has just completed erecting a new two-story factory building, 200x300 feet, constructed entirely of concrete blocks. Its shipments have extended to Italy and Sweden.

"ATLAS" THREE-TON GASOLINE TRUCK HAULING PAPER

"ATLAS" TWO-TON TRUCK WITH EXPRESS BODY

* *

The Knox Motor Company of Springfield, Mass., manufactures the "Atlas" commercial vehicles which are mounted on chassis dimensioned to support either a 2-ton or a 3-ton load.

The 2-ton chassis has a wheel base of 8 feet, and a tread of 58 inches. Its tires are 5 inches wide in the rear and 4 inches wide in the front. The weight is 5,000 pounds, and the average speed 12 miles per hour with load. To this chassis standard express bodies with 20 inch side panels or light truck bodies with a carrying space 9 1-4 feet long by 5 feet wide, are fitted. In addition to these, special styles of bodies are built to order.

The 3-ton chassis has a wheel base of 9 1-2 feet, and tread of 58 inches. The tires are solid rubber, 6 inches wide in the rear and 5 inches wide in front. Its weight is 6,000 pounds, and the average speed 10 miles per hour with load. The truck body normally fitted to this chassis has a carrying space 11 1-4 feet long by 5 feet wide. Especially designed bodies may be fitted to this chassis also.

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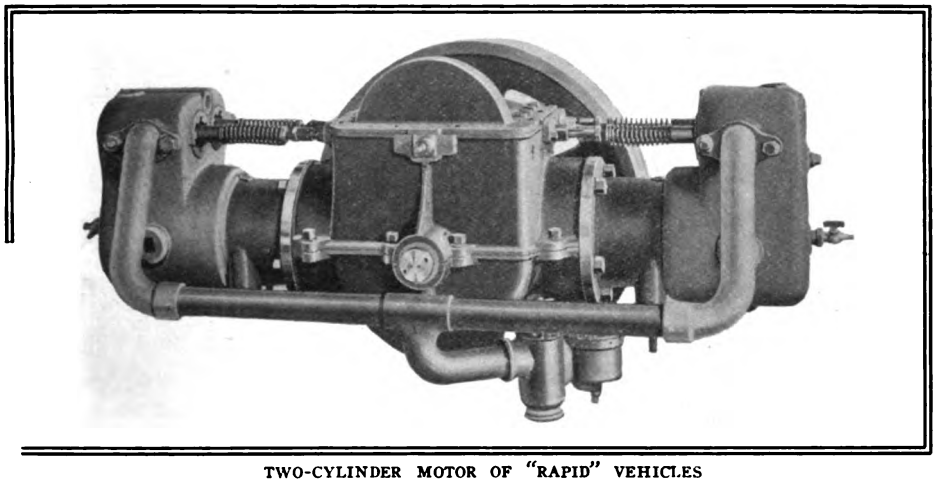
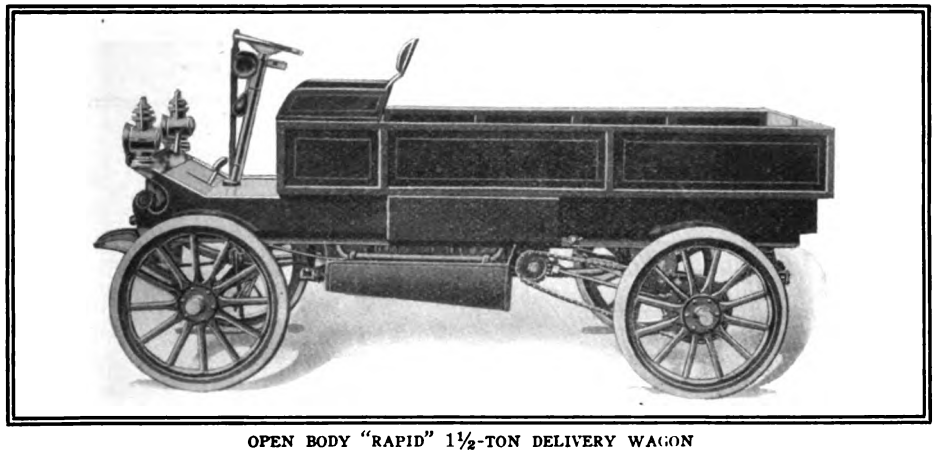
The engine furnishing the power for all "Atlas" vehicles is a double horizontal gasoline motor with cylinders of 6 inch diameter and 7 inch stroke, water cooled, and rated at 24 hp. The ignition is by jump spark from single non-vibrating coil, and the change speed gear is of the sliding type with steel spur gears giving 3 forward speeds and a reverse, and running in oil. The clutch is of the leather-faced cone type. The springs are full-elliptic in front and half-elliptic in the rear. One lever controls all the speed gears while the clutch and the main brake are operated by pedals. The lubrication is by force feed from one mechanical oiler which lubricates all parts of the engine, transmission and rear axle mechanism.

The "Atlas" trucks of 1906 pattern differ in many ways from those built by the same company last year. Some of the important construction features in these trucks are as follows: The machinery is mounted upon a channel frame rigidly connected to the rear axle and attached to the front axle by very flexible coil springs, affording a resilient support for the engine, independent of the stiffer vehicle springs and the weight of the load supported on the latter. The engine is placed close to the rear axle and connected to it by large spur gears. The crank shaft, valve shaft, all parts of the transmission and compensating gears and all bearings and connections for these parts are enclosed in one casing mounted upon the channel frame. The rear axle of the "Atlas" vehicles is so constructed that the load and road strains are taken by the outer stationary sleeve of the axle, while the inner rotating driving-axles, connecting with the compensating gear and with the outer caps upon the hubs of the driving wheels, are subjected to the driving effort only, as in some well-known touring cars.

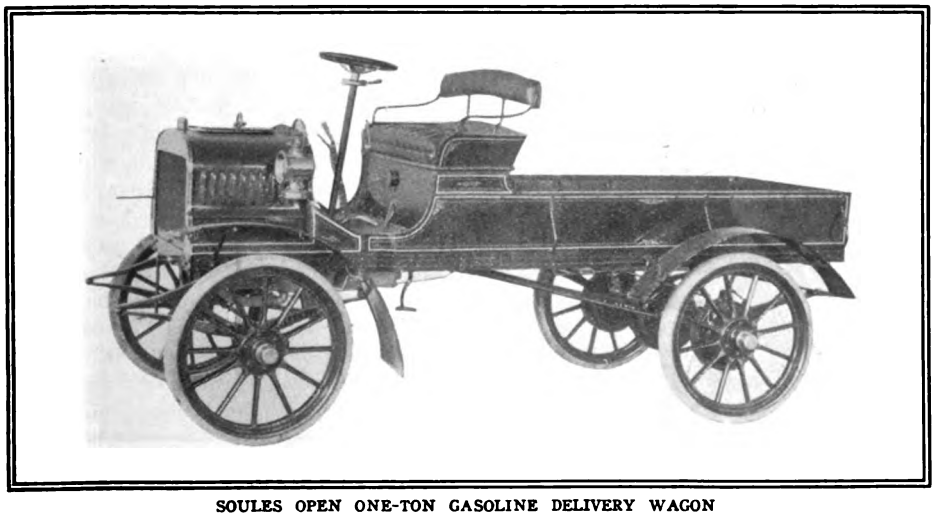
Using the same chassis, the company builds to order watering-carts, coal wagons with tilting bodies, trucks equipped with power winch for drawing cables, and passenger vehicles for up to 40 passengers. It has under preparation heavy delivery wagons of 1 or 2-tons capacity, and also 5-ton trucks.



TWO-CYLINDER MOTOR OF "RAPID" VEHICLES



OPEN BODY "RAPID" 1½-TON DELIVERY WAGON



SOULES OPEN ONE-TON GASOLINE DELIVERY WAGON

* *

The Soules Motor Car Company of Detroit, Michigan, manufactures a chassis equipped with either open body with removable top or closed body with wire panel sides. It also fits other styles of bodies to the order of customers, or sells the chassis alone. The motive power is a 22 hp. gasoline engine with 2 horizontal cylinders of the opposed type with cylinders of 5 1-2 inch diameter and 5 inch stroke. It is oiled by force feed and gives a maximum car speed of 12 to 15 miles per hour. The sliding gear transmission has 2 speeds forward and a reverse and transmits the power to the rear axle by driving shaft and bevel gear, the latter of the ratio of 6 to 1. The frame of the chassis is of angle steel rigidly constructed. The springs are 3-4 elliptic and the wheels are of either 32 in. diameter and shod with 3 inch solid rubber tires or of 34 inch diameter and shod with 2 1-2 inch rubber tires. The inside dimensions of the vehicle body are 6 feet in length and 40 inches in width and the load carrying capacity of the wagons is 1 ton.

* *

The Dunbar Manufacturing Company, of Sandusky, O., manufactures a light delivery wagon which may be used with or without top. It is especially intended for laundries, confectioneries, dry goods houses, drug houses, bakeries, groceries, butchers, and similar retail businesses.

The motor is a single cylinder, 8 h. p. engine, with mechanically operated valves. The cooling system includes a tubular radiator and positive gear pump circulation. The wheel base is 80 inches, and the wheel gauge 56 inches. The maximum speed of the vehicle is 12 miles per hour. The wheels are shod with either 28 by 3½ inch pneumatic tires in the rear, and 28 by 3 inch pneumatic tires in the front, or with solid tires, 28 by 3 inches. The carrying capacity of this vehicle is 1,000 pounds.

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Scrap Book Records for Wagon Owners

PRESS REPORTS OF ADVANCEMENT IN THE USE OF POWER WAGONS IN AMERICA—WITH COMMENTS

AN ERROR AND ITS SPREAD

QUOTING *Motor*, a contemporary automobile journal, in a comparison between commercial transportation by power wagons and by horses and wagons, the *Boston Herald* gives currency to the radical misconception expressed in the opening sentence of the following :

"One department of expense, that of drivers, is exactly the same in either system, but the operation of turning on and off the power and of steering is easier and less wearing than the driving of a pair of equine giants. The weight of a load on the motor could be almost twice that of the horse-drawn wagon, but its entire capacity is seldom used, because the man who drives and delivers cannot handle more than 60 half-barrels and 25 quarter-barrels on one journey. Pace, with a full load, as before stated, is always from 35 to 50 per cent greater with the motor vehicle than the horse wagon, but for emergency calls for smaller loads required at once, the difference is appreciably increased.

"It is too early yet to compare the length of the life service of an electric motor wagon, as against that of a horse-drawn outfit, but when a motor is kept in proper repair it has practically an endless life: whereas a horse, whether it lasts a year or 10, has a steady and certain decline. The parallel may be brought closer by comparing the legs of the horse to the tire of the motor car. When the tire wears out the loss is absolutely covered by putting on a new tire but when the one leg of a horse gives way the whole horse is useless."

The automobile journal from which the *Boston Herald* quotes, doubtless means to be correct and fair in stating that as many drivers are required for transportation by power wagons as by the old system, but falls into the common error of comparing one power wagon with one horse-and-wagon unit, instead of comparing it with what it replaces, namely, two to three horse-and-wagon units, thereby robbing the power wagon, in the estimation of readers who may credit the statement, either in the original or when quoted, of its very chief source of economy, which is beyond all question: The saving effected in the wages of drivers and attendants for a given amount of transportation work.

According full face volume to some of the other remarks contained in the quotation, the business man is further tempted to ask why, pray, the man who drives and delivers cannot handle more than 60 half-barrels and 25 quarter-barrels on one journey. If the load were larger, the journey would be longer, and then why not handle a few more barrels? Possibly the question of bulk capacity and some other more intricate considerations relating to the weight of vehicles and road conditions may have more to do with the load limitation.

"When the tire wears out, the loss is absolutely covered by putting on a new tire ———." The rest of the remark is apt and felicitous, but the condition is even more in favor of the tire than stated, for the outworn tire may normally be reshaped at a cost of 25 per cent of its cost price and its life thereby prolonged 40 to 60 per cent.

* *

RAILWAYS RECOGNIZE MOTORS

SO rapidly are improvements made in motive power that a community scarcely becomes accustomed to one mode of travel until another is advanced. A few years ago the electric traction line had solved the problem of inter-urban traffic. The trolley pole was the emblem of the acme of success. Now come reports that the motor car is to replace the trolley, and, indeed, a number of lines have already been incorporated.

The improved motor car as herein referred to is a car that runs upon a track the same as a trolley car. Instead of the motive power being electricity it is to be the gas motor. Its superiority to the electrically propelled car is proclaimed "all along the line."

One of the great drawbacks to electric traction lines is the power plant, which must be erected and maintained at a great outlay of capital. A motor car line requires a small investment—two rails and as many cars as are needed. Each car is a power plant of itself.

When not in operation there is no waste of power. When a motor car stops running its expense is shut down. There does not have to be a great central power house, consuming coal day and night, in order to have power when it is needed.

The steam roads will not be caught napping in the matter of the motor car lines, as they were in regard to the electric lines. Already they have under consideration the construction of numerous little lines, anywhere from five to fifteen miles in length, and which will co-operate with the steam roads. They are to be owned and operated by the steam roads as feeders for the steam lines. At least one steam road is securing the right-of-way now for a motor line, and at an early day hopes to have several motor cars in operation.

If the motor car demonstrates its adaptability it will be a small matter for the electric roads to change their cars. It is not apprehended at this time, however, that the motor cars will replace the trolleys for some time to come. The purpose of the motor car will be for operation on short lines of road that will be built all over the country. As many traction lines as we have out of this city there are several sections that may still not be reached by the trolley cars. These sections will gradually be pierced by the motor car line.—[From *Springfield* (O.) *Press Republic.*

Railway companies in contemplating to extend their service by means of vehicles driven by gasoline motors do not contemplate "road repairs" of these motors. They know that with proper caretaking at the end of journeys the motors will be good for taking the vehicles through, so far as the motor's engine-reliability is concerned, without stops for adjustments or "fixings" by the driver. The same class of motors, driving trucks and delivery wagons, may give the same reliable service under the same system of inspection, caretaking and maintenance in the garages as the railway companies have long ago learned to employ by experience with locomotives.

* *

BOSTON'S DEMAND FOR TRUCKS

IF a list could be made up of the business houses in Boston which are experimenting with motor trucks, those who believe that the horse cannot be ousted from his position in the business world would be much surprised. Every dealer in Boston who handles a commercial vehicle has upon his books for demonstration some of the largest houses in the city, and some whose teams have been the most conspicuous on the city streets. Demonstrations are being given as rapidly as possible and not a few have been converted to the motor truck, so that in the course of another year a very material increase in the number of these vehicles in the city may be expected.—[From *Boston Transcript.*

Though Boston had an early experience with motor trucks and delivery wagons which was not marked by financial success, the merchants of that city have had the excellent good sense of perceiving that stock jobbing and inexperience were the stumbling blocks which have since then been removed, and that the power wagons of 1906 coupled with the wide diffusion among drivers and owners of special knowledge on the subject of utilization and maintenance of power wagons, have placed them, even more than the merchants in other cities, in a position to reap all the advantages in the whole situation which have accumulated since the year 1900.

* *

SUBURBAN POWER BUS LINE

AFTER various false alarms in the way of proposed and promoted interurban lines, the securities of which have always proved indigestible in the financial market,

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Anoka, Osseo and the closely settled intervening country are to be connected with Minneapolis by regular automobile service. In effect it will be a suburban line without tracks. Two twenty-passenger automobiles, capable of good speed under full load in any kind of weather and making regular trips between Anoka and the center of Minneapolis over the Osseo road will be put in service soon.

Autos with bodies which can be thrown open or closed, according to the weather, will be used. The county road is one of the best in the state, and no trouble will be encountered from that source in any sort of weather.

Tho the train service is not convenient, over 30,000 round trips are sold over the two roads from the two towns with train service. The auto service will reach the business center of every town on the line, whereas both of the stations in Anoka are over a mile from the business center, necessitating the use of busses. A paying horse-stage line has been in operation for some time between Camden Place and Anoka, on the opposite side of the river from Osseo, and with but two trips a day.—[From *Minneapolis Journal.*

Some of the reasons given in the foregoing for believing that the projected power bus line should prove profitable, suggest a number of matters for investigation in other localities where the now so popular power bus schemes seem to be entertained in a spirit of too-sanguine faith in everything favorable. Probably it would be a serviceable act at the present juncture to draw an elaborate schedule of all the factors to be considered in power bus flotations and to send a blank comprising them all to those most deeply concerned in such plans, as an assistance in compiling necessary data for a financial estimate.

The Power Wagon will cheerfully furnish such a schedule, to the best of its ability, when requested to do so by persons interested in any one projected line, provided detail information of the plan and resources behind it is furnished.

* *

PROPOSALS FOR MAIL WAGONS

AN experiment with automobiles for mail delivery is to be made at Detroit soon, which, it is believed, will largely determine the attitude of the Postoffice Department toward the request of Postmaster Willcox for automobile deliveries to be established in New York. Heretofore automobiles have never been given a thorough test in the large cities by the Postoffice Department. The experiment in Detroit will be the most extensive tried thus far. Automobiles for delivery are in service in several star routes in the Far West, and, according to the reports of the department, are doing remarkably well, considering the rough character of the work they are compelled to do.

In New Mexico an automobile line is carrying the mails from Roswell to Torrance, a distance of eighty miles, through a comparatively new country. In Northern Utah the machines are in service from Dragon, the terminus of a railroad, to Vernal, a distance of about fifty miles. Both of these star routes have only recently been established. The means of transportation formerly used in both cases, as in all regions untouched by railroads, were stage coaches. Automobiles were first tried in the mail service in Buffalo, during the exposition, in carrying the mail from the main postoffice to the exposition grounds. They gave fairly satisfactory service. Postmaster Willcox believes firmly in the possibilities of the machine for the expediting of the mails in New York City, and will seek to have special opportunities given automobile concerns in competing for contracts.—[From Washington Correspondence to *New York Tribune.*

So far, the principal obstacle to the establishment of mail collecting and mail delivery service by power wagons has arisen from the inability of manufacturers to find time for paying attention to the subject and designing wagons adapted for the work. The postoffice department's requests for bids have remained unanswered or have been answered only by mushroom concerns offering no sufficient guarantees of responsibility.

* *

WHO SHOULD MAKE THE MOTORS?

THE Lake Shore & Michigan Southern Railway Co. has ordered seventy-five gasoline motors at its Collinwood shops, and they will soon be installed for suburban traffic. It is the purpose of the company to enter into competition with the electric roads on suburban traffic.—[From *Wall* Street Summary, New York.]

It is sincerely to be hoped that the Lake Shore R'y. Co. has done something more than merely "ordering" seventy-five gasoline motors. Unless the Collinwood shops have had the manufacture of gasoline motors under preparation for at least two years, the chances against their producing a really serviceable engine for the heavy work contemplated are overwhelming, if the experience of automobile manufacturers counts for anything. The six-cylinder motor recently placed in a Delaware & Hudson R'y. motor car by the General Electric Co. was even imported from England, but that was probably an error of judgment at the other extreme. The Chicago Commercial Motor Vehicle Co. of Harvey, Ill., spent two years in experimenting with cylinder castings alone, at its own foundry, before they thought they had something good enough to offer the public in their 5-ton Whiting truck.

ERIE GOES ABROAD FOR MOTORS

THE Erie Railroad has taken the initiative in the East in the matter of adopting the motor car for suburban service and has placed a contract for a Ganz steam motor car for trial on one of its branches. The use of these cars for this class of traffic is felt to be a future certainty, and several such cars with different styles of motor are already being operated in the West with success. The main advantage is that they are much more economical of operation than a whole train such as now takes care of local passenger traffic.

The operation of the present mixed trains is costly and in many cases a losing proposition. With the motor cars, however, the expense is reduced to a minimum, the service is better and cleaner, and time schedules may be arranged which will give more frequent service to all local points on a line. Furthermore such cars can be stopped at the smallest hamlets, greatly to the convenience of residents at such points. The trolley lines paralleling steam roads have proved to be serious competitors and railroad men are looking forward to some means whereby they can regain traffic which formerly was theirs exclusively.

The cost of operating these motor cars, it is said, is only 25 per cent of the cost of running locomotive trains. The speed of the auto car is practically unlimited, and they may be stopped at crossroads and handled similarly in every respect to trolley cars.

The new Erie car will be of steel construction, all the equipment being imported from Budapest. The car body will be built here. This car will be 57 feet long, weigh 40 tons and will seat 60 persons. It may be run at a rate of 50 miles an hour. The forward truck of the car will be equipped with two 50-hp. compound steam motors. Steam will be furnished by a small water tube generator (42 inches high by 36 inches in diameter), which can burn either crude oil, coke or anthracite coal.

The generator will be installed in a small compartment in the front end of the car, which compartment will have accommodation for the operator. When coke or coal is used the generator will be fired from the top through its central portion in much the same manner as the "base burner" stove. The control levers are to be operated in a similar manner to those of an ordinary trolley car. The steam motors will be enclosed in a dust proof case filled with oil. When running at full speed the fuel consumption will be about 16 pounds of coke or coal per mile. If crude oil is used it is claimed that the consumption will be less than one gallon per mile.—[From *Buffalo News.*

Is the competition between railway companies for securing suitable motors for individual motor coaches in suburban and

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local inter-urban service a sharp one? Some idea on this point may be formed from the fact that in nearly all reports of the railway companies' intentions which find their way to the press columns, the trials are to take place "on one of the branches" of the railway, but it is practically never permitted to be known on which particular branch. Prying eyes are not welcome. Each road strives to reach conclusions in advance of its competitor.

Secrecy unfortunately works both ways, depriving its author of the benefits which might be derived from nearby sources of valuable information. In the case of the Erie R'y. Co. it seems a pity that it should have found it necessary to go to Hungary—progressive and enthusiastic for scientific advancement as are the people of that newly liberated country—for a motor design. So far Hungarian engine and motor builders have been gluttons for fuel economy—a somewhat overrated feature in the true economics of the internal-combustion engine, however, valuable in steam practice.

* *

STEAM VEHICLES FOR ORE FREIGHTING

EXPERIMENTS with the automobile in ore freighting over mountain roads in Mexico will be made by the Mexican Consolidating Mining and Smelting Company of Boston, operating the Nueva Australia and Porvenir mines in the Guanacevi district of the State of Durango.

Two steam cars of 60-hp. capacity each are being built for the company in Buffalo, N. Y., and will be shipped to Mexico as soon as completed. The cars will be placed in service between the mines and some railroad point yet to be determined. It is possible to make connection with either the Mexican Central or Mexican International roads. John T. Judd, one of the principal stockholders in the company, is now in Durango for the purpose of deciding on the route and preparing the road.

Each car will be equipped with a drum containing stout steel cables, the cables to be used in facilitating the ascent of grades with heavy loads. They will be fastened to tree sor boulders some distance ahead of the machine, and will be taken up by the drum as the car ascends the grade. The experiment will be watched with great interest by other mining concerns in Mexico, and if it demonstrates the success of the automobile in ore freighting in mountainous country the example of the Boston company will be followed.—[From *San Antonio* (Tex.) *Express.*

* *

MOTOR BUSES FOR LAKE RESORTS

THE Milwaukee Automobile Transit Company has been organized to operate automobile buses from Milwaukee to several of the adjacent inland lake resorts. Active operations will commence early in the spring. The company has a capital of $15,000.

AUTOMOBILE FIRE ENGINE

THE board of safety in Alliance, O., is considering the installation of automobile chemical engines and hose wagons. The chief of the fire department wisely believes that the use of automobiles equipped with fire apparatus would avoid much of the expense incidental to keeping teams of horses, while at the same time giving more efficient service. And he supports his petition to the board of safety by stating that an automobile chemical engine now on the market not only carries tanks, hose and department men to the scene of fires at the rate of 30 miles per hour, but uses its power as a pumping engine to assist the water-works in affording a good pressure for fighting fires in outlying districts where the water pressure is low.

* *

THE THIRST FOR KNOWLEDGE

ALL over the country automobile schools spring up and are attended by men of all classes. The people are getting tired of running automobiles in the haphazard manner which breeds repairs and expense which might be avoided. Naturally, the tendency to take the care of motor vehicles more seriously will benefit the owners of power wagons first and foremost, resulting in placing at their disposal men who have shown their interest in the subject by voluntarily submitting to schooling and who will therefore afford needed material for what is most of all wanted in the power wagon service of business men, namely, earnest and competent foremen willing to learn all the time.

Cleveland, O., gives a good example of the expansion which is taking place in the school work referred to. There, as in many other cities, it is the Y. M. C. A. which has taken the initiative. These initials now stand facetiously for Young Men's College of Automobiling.

Beginning next Tuesday, says a recent press report on this subject, instruction in the operating and repairing of automobiles will be given daily and nightly. A class for owners and prospective purchasers of machines will also be in operation.

This unique departure from ordinary Y. M. C. A. work was decided on by the educational committee when it became known that the automobile school, in operation for the last two years, had become so popular that it was impossible to take care of all who wished to attend. It was then voted to engage a competent instructor to devote his entire time to the work, and to have classes both morning and afternoons, as well as in the evening, instead of at night only, as heretofore.

Louis J. Buschman, B. S., has been placed in complete charge of this work of instruction. He had already shown his fitness by his success as instructor at the evening classes. He is a graduate of the Case School of Applied Science, and has had several years of practical experience in the automobile and gas engine business. He has been given the title of principal and his service began March 1.

The instruction as mapped out will be of a thoroughly practical nature. It will be the constant aim not only to show the students how to operate, care for and repair automobiles, but also to make the reason for each act perfectly plain. The ground work will be laid in a series of sixteen explanatory lectures, illustrated with both stereopticon views and parts of cars.

The shop laboratory will come next. There the students will be taught all that is necessary for the competent chauffeurs to know. For instance, the carburetor will be thrown out of adjustment, and each will be set to test the efficiency of the engine until he finds the adjustment that will give the maximum power from the least amount of fuel. They will also be taught to set the exhaust and inlet valves so they will open and close in right relation to the explosion within the cylinder. Instruction will be given in how to set the ignition system so that the spark will explode the gasoline within the cylinder at the proper moment.

Having satisfactorily passed through this course, the student will be given practice in the running of a car. On a stationary car they will be taught how to control the engine and handle all the levers which change the speed. Actual road practice will follow when the desired efficiency has been reached. The men will then be as competent chauffeurs as schooling can make them.

It is expected that a large class of owners and prospective buyers will join the special classes which will be held for them Tuesdays and Fridays at 5:30 p. m. Men who desire to be tutored privately also will be accommodated. A class for salesmen and men who work in garages in planned to meet in the morning, when their work is lightest.

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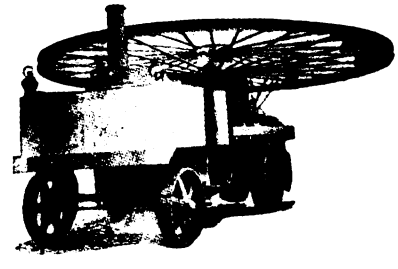
AN electric ambulance is to be operated at the military academy at West Point. It will be tried under service conditions at Plattsburg, N. Y., in the course of mobilization operations next summer.



HANDLING A 4-TON PULLEY WHEEL 40 MILES ON ENGLISH ROADS

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Traffic by Motor Power in Europe

MAINLY A DIGEST OF THE BRITISH AND CONTINENTAL TECHNICAL AND CLASS PRESS

MILLIONS FOR MOTOR BUSES

THE London General Omnibus Company, whose chairman (president) declared six months ago that the shareholders would find horse-drawn omnibuses to be the backbone of the company for some years to come, has appropriated one million sterling for the purchase of power buses, with the full approval of the shareholders. One-half of the five million dollars is to be realized from sales of horses and other property, the other one-half by a new issue of bonds.

An announcement of this important appropriation is accompanied in the latest issues of the British power wagon press with some exultation over bringing to time a large and conservative company whose previous policy seemed to imply a negation of power wagon economy.

British orders for power trucks and delivery wagons also seem to be rapidly increasing. The *Commercial Motor* writes on this subject:

Orders for self-propelled delivery vans give every promise of becoming a good second to those for motorbuses. We have not hidden away or disguised the many difficulties which have confronted pioneers during the past nine years, but there are now no sufficient grounds for adverse criticism: no carrier or tradesman can any longer withstand the tide of public opinion. The unmistakable demand for greater despatch in the transport of goods and parcels imposes conditions of service which are beyond the limits of animal power, and the reality of this subtle force has been both recognized and acted upon by not a few of our greatest carrying undertakings.

There are, however, hundreds of potential users who continue to look on from the outside. They, haltingly and with dangerous hesitancy, are waiting until it is "beyond question" that a motor will *save* them money, whereas their more up-to-date competitors appreciate the fact that the real function of the motor is to *make* money for its owners. A steamer, admittedly, costs more for operation and maintenance than a sailing vessel, yet no shipowner, whose foresight in the transitional days led him to be amongst the first to make the change, had occasion to regret it! And the analogy is not without instruction for those who are tempted to fold their arms and pose as wise men. Are not many of these courting as rude an awakening as has befallen the older London omnibus companies? Why invite competition by lethargic indifference? Our considered opinion, and one from which we know we shall have no occasion to depart, is that no trader can afford to ignore the effect of motor delivery services upon his business. To do so will convince his customers that the internal organization and methods of his house are also out of sympathy or keeping with the times. The thoughtful and farsighted man of business will refuse to listen to the warning of ignorance which advises a policy of *laissez faire*; he will order at least one van, and will re-arrange his rounds to suit its greater range of action and capacity for prolonged, consecutive services.

The "tide of public opinion" and the "unmistakable demand for greater despatch in the transport of goods" would seem to be somewhat brutal instrumentalities to call to the aid of the power wagon movement, if they were not wholly compatible with the pecuniary interests of merchants. *The Power Wagon* would prefer to show the merchants first on what side their bread is buttered and to deal with fickle "public opinion" and the "unmistakable demand" as mere reflections of demonstrated possibilities. An "unmistakable demand," however urgent, would probably not avail if it could not be met with profit and satisfaction to both sides.

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MAINTENANCE ORGANIZATION

UNKNOWN alike to the technical and lay press, Mr. de Prelle de la Nieppe has been quietly carrying on his work as chief engineer of the London Road Car Company, working very much in the background, but none the less effectively; in fact, it is largely due to his efforts that the chairman of the company was at the last meeting able to announce that the motors had made up the deficit caused by the horsed vehicles.

Mr. de Prelle de la Nieppe, better known among his men as Mr. de Prelle, stands for organization.

"I have heard a lot about your repair work, Mr. de Prelle," remarked our representative.

"Ah! yes, I will show you one or two little repairs if you come with me."

We followed our guide into the great repair shop, in which were a few omnibuses in various stages of dismantlement.

"Here," said he, "is a back axle that came into collision with a lamp-post and got broken off at the end. You see, it is repaired by tapping a piece in, and the piece so tapped in is locked securely, so that I defy any man to move it. I was advised to lock it with a set screw, but that would mean heating the end, drilling, and rehardening; that is not good enough, so I have locked it without, by simply dipping the screwed part in acid from an accumulator."

We went on, and were shown a crank case which seemed broken beyond hope of repairs, yet it was being repaired, and most effectively, too. A differential case was lying with the flanges at the end of the differential shaft bearings broken, but effectively put on again. We called attention to it.

"Yes, that got broken in an accident," said Mr. de Prelle, "and you see how I have repaired it. It is as strong now as ever it was."

The speaker was quite right; a finer sample of well-thought-out repair we never wished to see.

"How many buses have the Road Car now, Mr. de Prelle? " we asked.

"Let me see," said our guide, thoughtfully; "twenty-six Durkopps, twenty-five Straker-Squires, one Clarkson, and thirteen Germains, making in all sixty-five. The Germains are not running; they are to be sent back to Belgium. They are good little buses, and though they are only from 16 to 22 hp. they are very fast on the level; that is because they are so light—they only weigh 3 tons 8 cwts. empty. They are not sufficiently strong uphill, though, and are going back to be fitted with more powerful engines and different gears."

"What do you think of the Straker-Squires?" we went on.

"They are grand machines, and they are so accessible," was the answer. "See here," and he pointed to one machine that was having its engines examined. The fitter in charge of the job looked up, and called the chief engineer's attention to the fact that all that wanted doing was the fitting of one new gudgeon pin, as there was too much play at that point.

"That 'bus," said Mr. de Prelle, "has been over 20,000 miles with beginners learning on it, and has only missed very few journeys; that speaks for itself."

We remarked that that was hardly fair usage.

"Yes," was the answer; "you see, our horse drivers when they take to motoring apply the brakes in the same manner as they have been used to—they run right up to an obstruction, then out comes the clutch, and the brakes they go bang. It is very severe, but the 'bus can stand it, and very soon the men become experts."

Another 'bus came in with the cylinder jacket cracked on the outside, and slightly leaking. Immediately it was taken in charge by the fitters, who at once gathered round to take their instructions from the chief.

"Take some thin copper," he said, "and a round-nosed chisel, open the crack, hammer the copper in, and you stop that leaking by putting sal-ammoniac inside your water-jacket, leave it an hour, and then wash your cylinder-jacket out with clean water."

"You see," continued our mentor, "a 'bus comes in, and as soon as it has come, the fitters take charge of it. I have a system by which no 'bus is allowed to go out

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of these sheds without proper inspection, and everything that has to be done by fitters I tell them. With my organization, I can tell exactly what every 'bus is doing. Ah! you should come down to the garage at night when they all come in, and see how it is done."

When we arrived at the garage in the evening everything was very quiet and business like; 'buses came in and were immediately taken charge of. The men know what parts they have to inspect every night, and consequently the great machine of organization works smoothly and without friction.

We walked round the great shed, now lit brilliantly by electric light. Occasionally the foreman walked up and took his instructions. Here a man was found cleaning a machine so that the grit dropped on to the machinery. The engineer was on to him like a shot, and he was promptly shown how to work. Nothing seemed to escape the sharp eye of the chief engineer, who was in very truth "all over the shop."—[From *Motor Traction.*

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REAL ESTATE MEN, TAKE NOTICE

A NEW era is about to commence in the Manchester district with the advent of the motor 'bus. A company is now being formed, with a strong board of directors well known in the engineering world, to run a service of 'buses about the Manchester suburbs, inter-connecting them where at present no means of communication exists, and linking them up to the existing lines of trams and railways. The conditions of the Manchester suburbs are such that they are in nearly every case well supplied with travelling facilities into the city, both by train and tram, but there are no means of going from one to the other without going into Manchester and out again, travelling perhaps fifteen to twenty miles to get to a place only six miles distant. The present scheme, therefore, is to link up these various places by motor 'bus, at the same time opening out the cross roads for building purposes.

Arrangements have been made for the immediate delivery of forty omnibuses, enabling the company to start operations without delay. Eventually, it is proposed to purchase some 150 vehicles.—[From *Motor Traction.*

Similarity between the conditions referred to and those existing in the suburban districts adjacent to Boston, Philadelphia and some other American cities, will be immediately noticed, but probably it will here be considered a matter for the established street railway companies, rather than for a new and independent organization, to institute and operate belt line communications by power omnibuses. As a rule this class of traffic will not sustain an independent fare under American conditions, while under the transfer system it may thrive and contribute greatly to that upbuilding of intermediate, thinly populated territory to which allusion is made. Some form of co-operation between the street railway companies, the real estate owners and the powers who allot the funds for road-building, seems to be strongly indicated as desirable, and the power omnibus is, of course, the only available means for bringing them together where the traffic will not pay dividends on a trolley line.

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POWER BUS TRIALS IN PARIS

ALTHOUGH the construction of the underground railway in Paris, and its continual extension, in accordance with the general plan, to many parts of the city has caused an active competition with the omnibus system, no serious attempt has been made until very recently to meet this competition. In some portions of Paris omnibus lines from which a large portion of the traffic has been diverted have been discontinued, but on the whole an extreme conservatism has been shown in dealing with the question of improved transport on the surface. Meantime other cities have shown activity in the improvement of methods of surface transport, and in London the automobile omnibus has made greater advance in public favor than in France, notwithstanding the success which has attended the development of other types of automobiles across the channel.

In a recent issue of "Le Genie Civil" an account is given by Col. Espitallier of the difficulties which have been in the way of the automobile omnibus in Paris, and the plans which have been made to overcome the obstacles which have deferred the advent of such vehicles on the streets. An important element in the supercession of the horse by the machine is that of operative cost, and in this respect London, under different fiscal conditions, has a great advantage over Paris. Thus the "essence" (gasoline) which constitutes the most suitable fuel for such vehicles costs only seventeen francs per hectolitre in London, while in France the price is increased by ten francs for duty, and in Paris by twenty francs more for the municipal tax, the selling price being forty-seven francs fifty centimes per heceolitre. For the 300 omnibuses operated by the Paris company this means a cost of 2,500,000 francs per annum greater in Paris than in London. There is, therefore, in Paris a necessity for the demonstration of the actual operative efficiency and economy of the automobile omnibus before a company such as that controlling the Paris omnibus system can feel justified in making the change from animal to mechanical power, with all the investment outlay which it involves.

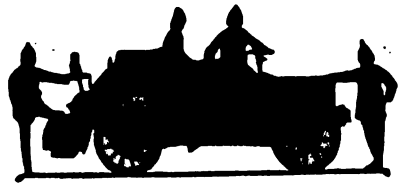
[Why so sure of an investment outlay? Immense real estate values may be released by the conversion.]

Compagnie Generale des Omnibus invited a number of eminent builders to submit such vehicles to a series of identical trials. As a consequence of these investigations a regular service was started between the Bourse and the Pont d'Alma and maintained during the month of December, at the time of the Automobile Salon, with much success. The time for the traverse of the course was nineteen minutes, which, with a stop of five minutes at each terminal, makes forty-eight minutes for the round trip, and this schedule was maintained with perfect regularity.

There is a general similarity in appearance in the different machines, this being due to the fact that each manufacturer furnished his own chassis, while the bodies of all the vehicles were supplied by the omnibus company from standard patterns. As a matter of fact, it does not appear that any of the machines were especially designed for the special service in the streets of Paris, the running gear in each case being that already devised for trucks and lurries for the transport of merchandise, the omnibus bodies being mounted upon the chassis to convert these vehicles into passenger omnibuses. Nearly all of the machines submitted for trial were operated by internal-combustion motors connected to the driving axles by gearing, but among them were some using electrical transmission, the motor driving a dynamo feeding electric motors on the axles, this system giving great flexibility of control, necessary in the crowded streets of a great city, while one vehicle used the Serpollet system, involving the steam boiler of the instantaneous flash type and the steam motors associated with this design.

In general, it appears that motors running at speeds of not more than 300 to 900 revolutions per minute are better adapted for omnibus service than those running at higher rotative speeds. In view of the occasional steep grades to be overcome, it has been thought advisable to provide from 30 to 34 hp., the omnibuses themselves weighing from four to five tons, in addition to the weight of thirty passengers and the conductor. The results obtained in service in the streets of Paris show that the cost of fuel is about twenty centimes (4 cents) per kilometre.

One of the important elements in the operation of automobile omnibuses is the question of tires. The various machines submitted in the trials were equipped with tires of various types.—[From *Engineering Magazine.*



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WAGONS FOR GOLD TRANSPORT

ONE of Boston's financiers, Mr. L. M. Hart, has extensive interests in Mexico and among his enterprises are several gold mines. Ever since these mines were opened there has been trouble with the Yaqui Indians. The nearest railroad is many miles away, and all the gold taken from the mines must be sent there for shipment to the north or the capital. It is the custom of the Yaquis to attack the gold trains, swooping down on the guards in the narrow passes and mountain roads. As a consequence it has been found necessary to increase the number of guards until the gold train now resembles a small army. The utmost caution is always necessary, scouts being sent out in advance. Although this is in a civilized country the Mexican Rurales have never found it possible to clear the mountainous region of the Indians, who, on the approach of the troops fly to their hiding places, to venture out again on the approach of the gold train. It will be remembered that less than a year ago several Americans were murdered by the Yaquis while on a visit to their claims.

Mr. Hart became convinced that automobiles could be used to advantage in the transportation of bullion in Mexico. Among other advantages counted on were the facts that only one-tenth the force of men would be needed in carrying the gold and the time consumed would be, at the very least, but one-fifth of that now necessary. The saving in cost would, for these reasons, be an appreciable one. No ordinary touring car could be used, however. A war car was required. Taking the matter up with an automobile manufacturer of Buffalo the preliminary plans for a suitable vehicle were drawn. The chassis and larger portion of the body are to be of the regular stock model touring car, but there the resemblance ends. Bullet proof armor plate will be used to protect the working parts, the front seats and the tonneau, so that machinery and passengers may be safe from attacks both on the level ground and while running through defiles where an attack from above might occur.

A place will be provided in the tonneau for carrying gold and either one or two rapid fire guns will be mounted in the front and rear compartments of the body. The rapid fire gun feature, it is expected will be a great advantage since now, owing to the topography of the country it is almost impossible to transport any heavy arms of defense unlimbered and ready for work at a second's notice.

* *

MORE CAPITAL FOR ATLAS TRUCKS

ON April 1 Walter G. Morse, who for six years past has been president of the Second National Bank in Springfield, Mass., will become secretary and treasurer of the Knox Motor Truck Company in that city. The capital stock of the Knox company has been increased from $150,000 to $250,000, the sum thus represented being the investment made by Mr. Morse. Harry A. Knox is president and W. S. Pease, vice president of the company.

MORGUE MOTOR AMBULANCE.

THE commissioners of Allegheny county, in which Pittsburg is located, have decided to provide the county morgue with an automobile ambulance. As a result of the installation four horses and two wagon ambulances will be displaced the moment the motor vehicle is put in service. The commissioners state that the practice of keeping horses in the morgue building has proved offensive. It has been conclusively shown that the horse-drawn ambulance is too slow for the long distance trips which must be made, and that the loss of time to the deputies, and other civil servants who have to ride in these vehicles, is of itself enough to justify the installation of a power ambulance.

* *

ECONOMICAL LIBRARY WAGONS

AFTER a year's experience the Chicago public library authorities have come to the conclusion that the three motor wagons which have been in operation during that period have performed their service at one-third the cost of horse-drawn vehicles. The average cost of operation per mile is .015 cent.

A motor bus transportation service has been commenced between Albany and Schenectady.

The city council of Coshocton, O., are considering the installation of motor-drawn fire department vehicles.

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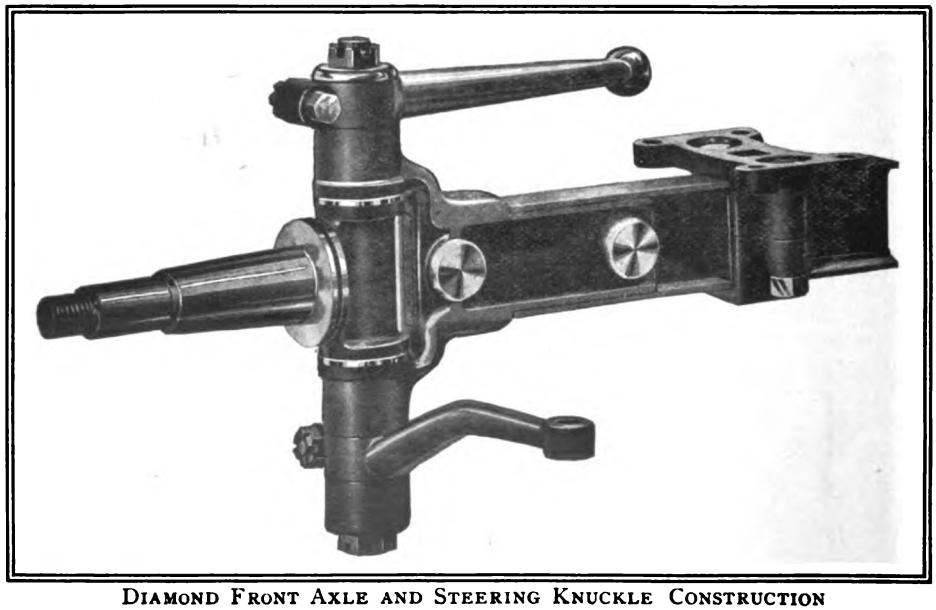

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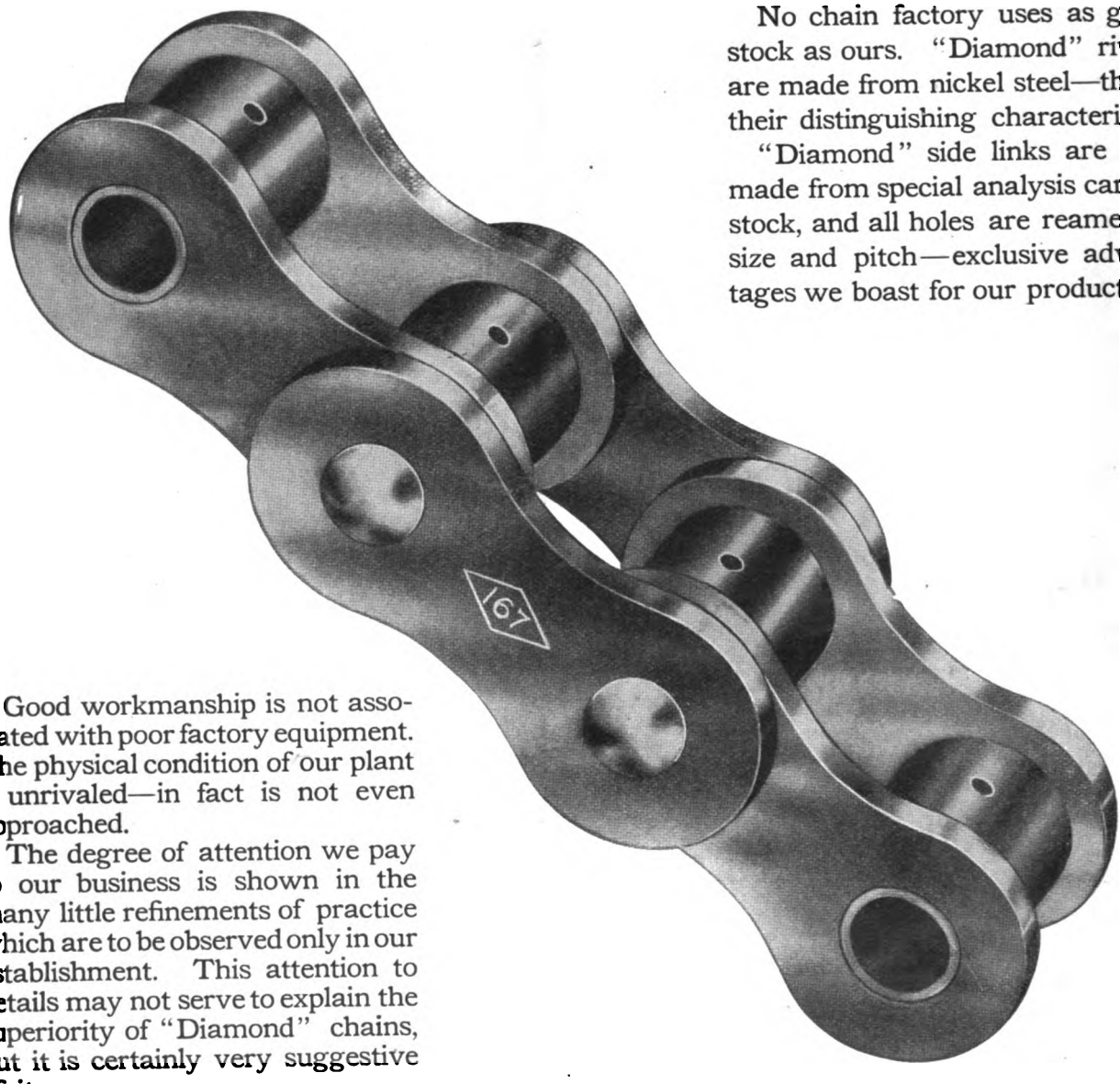

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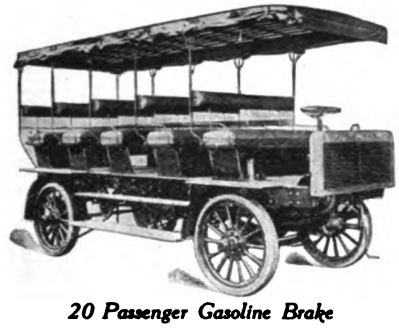

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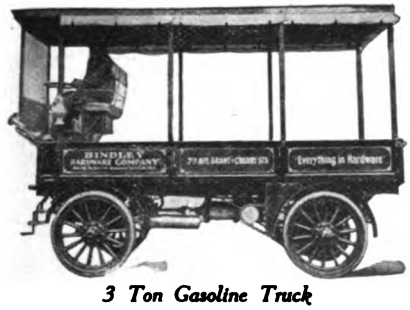

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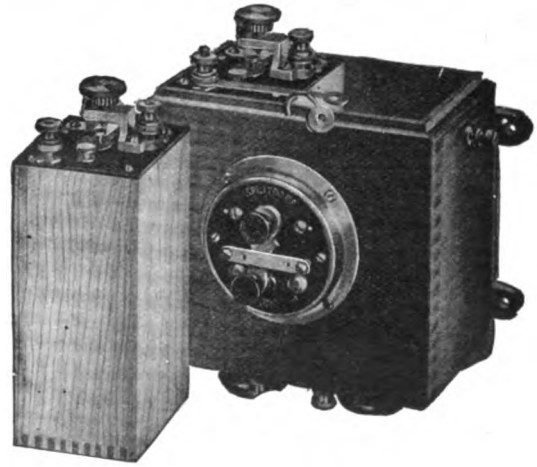

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Fogyism in Mail Service

Indifferent Attitude of the Government to Economy by Power Wagons

NO one would blame the United States Government for being slow to adopt motor vehicles among the instrumentalties for performing its work, if there were method in the slowness. The Government cannot fail to recognize that the motor principle in transportation has come to stay and that various departments of public administration have business involving transportation work which may or may not be done better or more economically by the power wagon system than by older methods. If no investigation is made it must be difficult for the administration to tell whether they are doing their full duty or wasting the public funds. The criticism may perhaps be hazarded that any government which undertakes to lead in agriculture, by maintaining experimental stations and sowing radical agronomic literature broadcast, and which pushes commercial interests into new spheres by acquiring colonies and building canals in foreign lands, does fail in its full duty if it fails to investigate what such a powerful factor as the automobile movement constitutes in modern civilization, may be utilized for in the discharge of public work.

In view of the indifference shown in every governmental branch, save only that of the War Department where economy is a minor consideration, toward the utilitarian employment of power wagons, the American people would be justified in drawing the conclusion that motor vehicles must be distinctly uneconomical or unreliable or both under any and all conditions which it is within the power of the Government to provide or create for its transportation work. They would be justified in drawing this conclusion, were not the rest of the world, comprising a number of conservative European governments, much more wrapt in considerations of economy than our own, in accord on this, at least, that the possibilities of motor vehicles are fully entitled to examination and investigation with all the competence that can be brought to bear on the subject through energetic, first-hand governmental experiments.

As matters stand, the United States Government seems singularly remiss, taking an attitude as if it had no business to step into the breach before all difficulties shall have been cleared away and all data shall have been gathered.

It is doubtful if the saving of drivers' and attendants' wages incidental to motor vehicle service has ever been considered in Washington.

Apparently the whole automobile movement has been viewed there solely through the eye of the daily press, as something sensational and lurid, fit only for ostentatious sport, of dubious sport value, and possibly for war.

The attitude of the Washington authorities on the question of collecting and delivery of mail matter has been characteristic of the attitude in most other directions, characteristic, it seems, of a biased and unreasoning viewpoint.

They have the right to consider reliability in mail service first and foremost, but not to take for granted that whatever measure of reliability was attained by enthusiastic and possibly foolish or credulous local mail-carrying contractors, must be the full measure of which the motor vehicle is intrinsically capable under intelligent care and management.

The advancement and magnitude of the motor vehicle industry demand that the Government shall not subvert popular faith in the value of its product, by placing an official stamp of unreliability upon it through entrusting the test of its qualities to incompetents.

That this is what has been done appears plainly

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from the reply received last fall from the fourth assistant postmaster general in response to a private inquiry. The reply set forth that

"rural carriers are required to provide themselves with suitable horses and conveyances for use in serving their routes, and the department does not permit the use of the vehicles named.

"Carriers in different parts of the country have been permitted to experiment with automobiles in serving their routes, for the purpose of testing their utility in the rural free delivery service, but these experiments have demonstrated that, owing to the varying condition of roads, unbridged streams and defective mechanism in the construction of automobiles they can not be relied upon, and for these reasons, which also apply to motor bicycles, the department has declined to permit carriers to regularly use automobiles and motor bicycles while serving their routes.

"Furthermore, regarding the use of motor bicycles and pedal-driven bicycles, it is quite difficult for a rural carrier using these vehicles to carry with him all the necessary equipment and postal supplies required of him and properly protect the mail from the elements.

"The department, however, sanctions the use of automobiles, motor bicycles and pedal-driven bicycles at such times as it is necessary for the carriers to rest their horses."

* * * *

In every other country within the pale of civilization and benefits of postal service there are mail routes where motor vehicles may be used and maintained under a proper system for safeguarding their reliability, if necessary, under the direct supervision of Government employes. All the postmasters in this country could be made to report upon the conditions in their respective districts, and, no doubt, men could be selected from the Postal Department in Washington who, after a careful study of motor vehicle possibilities, could make a selection of routes or combinations of routes upon which the Government, backed by all its resources of competent investigation, could try out the new method. Then, if the results were not satisfactory, the Government's adverse decision would be the mature fruit of the investigation craved and demanded by the logic of the whole situation, and not a slap in the face from a bullying authority.

In comparison it is interesting to cast a rapid glance over the attitude taken by other governments. It is exemplified in a few news reports taken somewhat at random —at a moment's notice—from the European press:

An automobile parcel and general mail service was recently established between London and Brighton, a distance of 53 miles. Formerly the service was conducted by horses and stages. The British postal authorities have contracted with the well known and enterprising omnibus proprietors, Tilling Bros., for the operation of three 24 hp. gasoline vans, the chassis of which are in all respects identical with the motor buses the firm operates in London. Mail sorters travel with these vans and distribute and receive en route. The maximum load is 4,500 pounds. Trips are made in the night.

The royal mail is carried between Manchester and Liverpool by three motor vans powered with 16 hp. four cylinder engines. The vans weigh two tons and carry two tons. Wheels are fitted with immense solid tires, and as the roads are bad are the cause of much trouble. At first steel tires were tried, but soon were abandoned for local reasons.

Eight automobiles are to be operated at once in the Bambay, India, district postal service.

In support of the motor vehicle parcel and mail service between London and Brighton, an appropriation of one million sterling was subsequently proposed in the British parliament and when last heard from the chances for the passing of the bill seemed favorable.

From France:

Last month fifteen electric mail wagons were placed in service in Paris. Loaded, one of these wagons weighs 5,280 pounds. Accumulators weigh 1,320 pounds; frame, motor and body, 2,222 pounds; operators 300 pounds. The remaining useful load is 1,430 pounds.

The motor of the wagon used in the Paris postal service is located in the center of the chassis. Transmission is effected by means of side chains. Twelve vehicles are kept in constant use and three are held in reserve. These wagons are taking the place of forty horses.

The Paris post office employs six hundred horses.

In Madagascar, a French dependency, six automobile wagons had been in service for seven months in the collection and distribution of mail matter, last summer.

Germany furnishes a few examples:

The German government regards with favor the extensive use of motor wagons for mail delivery. Already it has projected and approved plans for several omnibus lines as feeders to the government railways, and the delivery of light freight and express by motor wagons having a capacity of one ton.

In Berlin an electric parcel post van has been in service since 1903, and eight motor vehicles are used by the carriers who have contracts with the postal authorities. Quite recently, however, the government decided to operate its own electric motor mail wagons, and the first of them is now in service in Berlin. Electric vans and light motor tricycles will also soon be operated by the Berlin postal department.

In Berlin letters and parcels are to be transported by motor tricycles. Thirty of these vehicles have been ordered. The engines are to be 4 hp., started by means of a crank, water cooled, two speeds. The useful load is set at 600 pounds.

Spain, Russia and Denmark contribute to the unanimity of enlightened public opinion on the subject:

The postmaster general of Spain has decided upon the purchase of eighteen motor cars for the post-office department. The total cost of the cars is expected to be about $83,000. The annual expense of the service is figured at $26,000, which includes $8,000 for wages of twenty drivers, $4,000 as wages of twenty assistants, $6,500 for fuel, and $2,400 for garage rent, light and minor items.

The Russian government uses two motor wagons for the delivery of mail in Odessa. The useful load of these wagons is 600 pounds. They are fitted with 6 hp. engines, with friction disc change gear. Another wagon of the same type, but with 8 hp. engine, and load capacity of 1,000 pounds, is used to transport express matter. In Russia, as in Germany, light express is carried by the postal department.

The Danish Automobile Works, of Copenhagen, Denmark, have delivered one 10 hp. and three 25 hp. motor cars to the Danish post-office department, which will use a dozen motor vehicles to deliver and collect mails in various parts of the country where railroads are lacking.

* * * *

Reverting to this country, it is to be said in justice to the Postal Department that whatever initiative has been taken for trying motor vehicles in Gevernment work—

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military affairs apart—has sprung from it. In some cases bids to furnish mail wagons conforming to certain specifications have been invited and the replies came invariably from irresponsible manufacturers or not at all. It is possible, then, that there has been a perfunctory willingness to see what the motor vehicle industry could do to improve the mail service, but the willingness has never been more than perfunctory, or else a greater ability and a firmer purpose would have been displayed. To advertise for bids and at the same time to curtail the bidders by an unreasonably short time limit and to forego all direct appeal to manufacturers for reasons usually classified as red tape, are the indications of a proceeding meant more to discharge a formal obligation than to obtain results. At all events this sort of methods evince no study of the subject, and in the absence of direct information of details, one is justified in presuming that the specifications insisted upon were such as no manufacturer could undertake to comply with.

From what may be learned by casual inquiry, it seems that demands for reliability were formulated absolutely without reference to what system or quality of maintenance would be given the vehicles after they were taken into use. No self-respecting manufacturer could respond to demands of that nature.

Among the possible customers of the power wagon industry the National Government, more than any private firm or corporation, could be expected to employ experts to investigate conditions, formulate reasonable demands and secure the organization of the contemplated services.

But so far, when it has acted at all, it has been upon a basis of mere untechnical newspaper knowledge or loose hearsay, the results, compared with those obtained by some private users, proving a minimum of liberal intelligence in the means employed.

One factor in the postal service has accentuated the general confusion. The object aimed at has in all cases been that of increasing the efficiency of the mail service in places where the horse and wagon service was notoriously inadequate. But, as postal service is not expected to be self-supporting in each locality, being considered as one gigantic business operated upon the patriarchal principle that New York and Chicago shall pay for the facilities of Sleepy Hollow and Podunk, the "greater efficiency" is not in any one instance measured with an economical rule. It is a sort of self-contained efficiency measured, if at all, in the acclaim of local voters. A motor vehicle service undertaken in this spirit runs naturally to frequency of trips and deliveries and to neglect of economy; since economy is the ignored factor. It so happens to be, however, that economy and reliability are tied up in one bundle, labeled "systematic and skilled maintenance." When economy is neglected, reliability suffers. In other words, in embracing motor vehicle service the Government assumes the duty of embracing also motor vehicle main-

Postmaster F. B. Dickerson, of Detroit, considers it the crowning feature of his administration that after nine months of constant endeavor directed upon securing government permission to institute mail service in his city he finally received permission during the latter part of February to close a contract with a local automobile firm for the delivery of mail from the Post Office to the new substation F, located at Lyman Court and Russell St. During the rush service incidental to the holiday season last Christmas mail delivery by motor vehicles was given a trial with the four vehicles shown in the accompanying illustration, but as the service was in the nature of emergency work and altogether exceptional, the conclusions reached at that time were not applicable to service throughout the year.

The service now to be established will call for a round trip in 40 minutes, the distance being 4 1-2 miles each way to station F, and seven round trips will be made per day, starting at 6:30 in the morning. It has been shown by trials that the vehicles make the trip one way in 15 minutes. Postmaster Dickerson figures that the service in this instance will cost $2100 more than wagon service per year, but that it will be so much more effectual as easily to make up for the extra cost, as the numerous factories in the vicinity of the new sub-station could not be accommodated by the slow wagon service.

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tenance, and not leaving the latter to the accident of local understanding of the subject.

May the Government, when hereafter it promotes the employment of power wagons, follow the admirable plan of one well-known jobber in ball-bearings who insists, before accepting any order, upon knowing the exact conditions under which the bearings are intended to be used. The maintenance of ball-bearings is anything but onerous, but the possible stresses are important. In motor vehicle service the stresses are important, to be sure, but the maintenance still more so.

It may be difficult to control maintenance in an installation of mail wagons operated by private parties on a contract plan. If so, the upshot of the condition which confronts the Postal Department is a moral obligation to assume the maintenance control where such service is established or to establish it only where the entire operation of the system is in its hands. It would soon accumulate special experience permitting it to dictate suitable terms and methods of maintenance to individual mail service contractors. The entire country would be the gainer from the experience so disseminated.

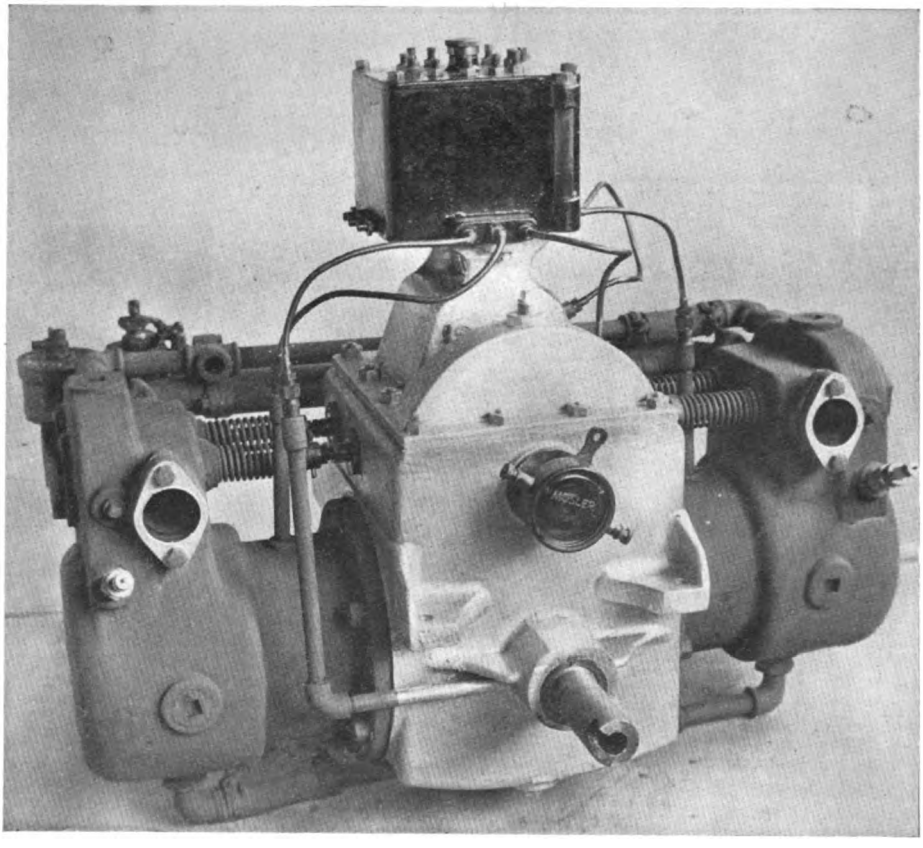
The first step, it would seem, should be in the direction of selecting and organizing routes on which power wagons may be installed in service with a view single to economy and the concommitant reliability, without attempting to graft onto this purpose the complication of a more efficient, viz. frequent, delivery of the mails. To start with that which is most difficult and least conclusive seems amateurish, whatever may be the degree of urgency in each instance.

And in view of the unjust strictures upon the inherent qualifications of power wagons for the Government's postal work, which have already been implied by this reversal of the natural order of things in the past, it is indefensible.

Trucks at Play

"ALL work and no play, etc."—without the "stunts" the power wagon would be a dull machine. Every creature in the days of youth must unfold its powers in sport and play, athletics and contest, in order to gain its own confidence no less than to convince and impress the surrounding world, and above all to find and extend the limits for its capabilities through reaching beyond them.

The power wagon is in no exception, though endowed with the universal instincts for self assertion and self development only through its maker as a proxy. Hail the manufacturer who takes enough pride in his offspring to put it through the paces and double hail if he wisely commits to the photographic plate the recollection of the particular form of prowess of which his mechanical child proved itself capable. In schools and colleges the sympathetic professor delights in the physical feats, courage and alertness of the student who also gives promise of a useful career by attention and ability at the desk and in the laboratory, while neither the flabby bookworm nor the vainglorious athlete who falls behind in the studies excites admiration. Similiarly, there is something refreshing in the gambolling stunts of the staid young truck, soon to be tied down to the monotonous earning of plain commercial profits, while the machine constructed especially for useless wonder-performances draws only a qualified hurrah followed by a sigh at the misdrection of efforts.



THE HORSE THAT PULLS TRUCK WEIGHING 3000 POUNDS AND DEAD LOAD OF 3200 POUNDS UP A 35 PER CENT. GRADE.

No one with the slighest comprehension of power wagon affairs fails to preceive that the most extraordinary test of performance—of the kind which may be

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shown in a picture—must fall short of proving economy in daily use, the prime essential in commercial employment, but, on the other hand, no one should fail to realize that the extraordinary performance, graphically shown, proclaims to thousands who don't know what power wagons can and cannot do just what is still considered unusual and specially meritorious and thereby enables the prospective purchaser of wagons to gauge with some accuracy their fitness for coping with the work he has on hand for them.

LAMBERT MODEL A TRUCK ON TEST, DRAWING A CAST IRON ENGINE BED WEIGHING 3200 POUNDS UP A 35 PER CENT. GRADE—MOTOR TWO-CYLINDER OPPOSED 5½'' x 6''.

We severe arithmeticians who must habitually brush aside all that is merely pictorial in order to get at the facts and figures with unwarped judgment, have reason to be thankful for every dash of color that may be thrown over our black and white subject without marring the true perspective. Pictures as well as words and figures can lie. Not only may they be "doctored," doctored innocently or with intent to deceive, but they may suggest by the mere selection or arrangement of the subject what never was or took place. We are grateful for those that are truthful in the essentials.

The picture presented herewith was made especially, it is believed, to convince doubting Thomases that the Lambert friction drive is sufficiently positive to pull enormous loads up steep hills, or, in other words, that the friction drive will do as much as any gear drive in this respect. Probably this is exactly the point where the world at large may be doubtful, but it is a fact nevertheless that almost any friction drive would do as much when new, and that the special virtues of the Lambert drive do not reside in anything shown in the picture but in the use of certain materials in the friction disks—aluminum in the flywheel disk facing and strawboard fibre in the disk working edgewise. Probably the world at large also forgets that every motor vehicle, with only one or two exceptions, is operated by friction where the tire touches the ground. Why so severe on another friction element, better protected, higher up?

Nevertheless the picture is interesting. The public has been surfeited with accounts of hill-climbing contests of automobiles. The impression has been created that it was something wonderful for a gasoline machine to propel itself over a steep gradient, and, while this impression is giving way to a better understanding, many still believe that the gasoline engine is unadapted for pulling heavy loads.

What a simple engine it is, too, in this case, as shown in the second illustration! This is the horse which pulls *that* load up *that* hill, without discomfort to any living creature.

Is there not food for reflection in this, as to what the power wagon is going to be in this civilization with its immensity of work before it and its scarcity of men willing to work for any one but themselves?

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Some Critical Opinions

Discriminating Readers Express Their Views of the Work "The Power Wagon" is Doing

SOMETHING REALLY HIGH GRADE

I have just finished reading the first number of the "Power Wagon" and I congratulate you very much upon it. It is refreshing and encouraging to find something really high grade in the field where inferiority seems to be the general rule.

H. P. MAXIM.

Hartford, Conn., March 23, 1906.

SPLENDID STANDPOINTS

We have received the first copy of Power Wagon, and the writer is free to admit that from a great many standpoints, it is certainly a splendid paper. We trust that you will have every success in the world with your publication.

The writer was one of the early pioneers in the commercial car field, and has done a great deal of experimenting.

Wishing you every success.

THE LOGAN CONSTRUCTION CO.,
B. A. Gramm, Vice-Pres. and Gen. Mngr.

Chillicothe, Ohio, March 21, 1906.

PREDICTS GREAT SUCCESS

The initial copy of your periodical came to my desk, and I was much pleased with its appearance. The reading matter certainly contains valuable information and instruction to all interested in cheapening city hauling and economic possibilities of the commercial motor vehicle.

After a careful perusal, I predict for this paper great success and feel confident that it will become a factor in the world of commercial motor vehicles.

SCHWARZSCHILD & SULZBERGER CO.,
L. A. Harris, Mail Order Dep't.

Chicago, Ill., March 21, 1906.

"GOOD THINGS" CONTAINED THEREIN

We desire to acknowledge receipt of first number of Power Wagon. Permit us to congratulate you upon its appearance and the "good things" contained therein.

OLDS MOTOR WORKS.

Lansing, Mich., March 21, 1906.

SHOWS STRONG GRASP

I have looked over your new paper "The Power Wagon." You certainly have shown a strong grasp of the subject, at least for the first issue. I wish you every possible success. I am very sure from the standpoint of the trade that you will make a most creditable newspaper.

THE GEORGE N. PIERCE COMPANY,
Charles Clifton, Treasurer.

Buffalo, N. Y., March 19, 1906.

ALREADY INTERESTED

"The Power Wagon" reads well and I have already become interested. Wishing you every success, I am,

FIRESTONE TIRE & RUBBER COMPANY,
Jos. M. Gilbert, Sales Manager.

Akron, O., March 20, 1906.

WORTH MUCH MORE THAN IT COSTS

Enclosed herewith please find $2 for one year's subscription to your journal. We received the initial number and have carefully studied its contents, and desire to congratulate you on same. I think the first copy alone is worth several times the price you ask for the whole year.

TORBENSEN MOTOR CAR CO.,
Viggo V. Torbensen, President.

Bloomfield, N. J., March 23, 1906.

SEES THE FIELD

I have read the first issue of the "Power Wagon" through and with a great deal of interest. There certainly is a very wide field in this line of work and no doubt it will develop into a very large industry.

Wishing you every success,

IMPERIAL WHEEL COMPANY,
C. B. Hayes, General Manager.

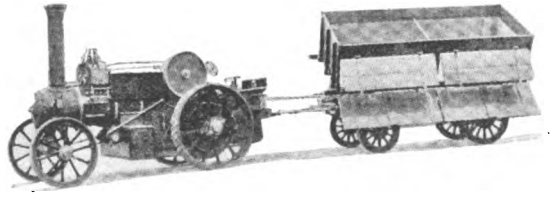
Flint, Mich., March 23, 1906.

TIME RIPE FOR WEEKLY JOURNAL

I desire to congratulate you on the new publication, "The Power Wagon," and I can see no reason why this journal will not cover the field. Knowing you as I do there is not the slightest doubt in my mind but that you will make a grand success of this journal. The field is before you and the time is ripe. I wish you every success.

CADILLAC MOTOR CAR COMPANY,
William E. Metzger, Sales Manager.

Detroit, Mich., March 21, 1906.



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Care of Electric Vehicles

A Simple Study of a Great Many Matters Vital to Their Proper Maintenance

DURING the process of charging ventilation should be provided for the gas and spray which will be given off towards the end of the charge.

The amount of current which should be put into a battery at the beginning of the charging will depend on how much the battery has been discharged, so that the lower the point of discharge the greater will be the initial amount of current which may be put into the battery without injury. As the charging proceeds, if the conditions in the charging circuit should remain the same the amount of current taken by the battery would decline because the internal voltage of the battery rises and thereby resists the flow of current into it. Therefore the charging circuit must be so regulated by means of the rheostat that an unvarying or constant amount of current is kept going into the battery until the voltage rises to its maximum and the battery is charged.

ADVANTAGE OF A LONG AND SLOW CHARGE

Where there is plenty of time to give the battery a long, slow charge at a low rate, this method will have the advantage of preserving the plates from the disruptive action of a quicker charge; but if the charge must be accomplished in the least time possible then a higher rate of charge than usual at the beginning will be less detrimental than if this proportionately higher rate were continued throughout the entire period. In fact, it is considered good practice, if the battery is fully discharged, to increase materially the normal rate at the beginning of the charge.

As three-quarters of the discharge rate is the normal rate for charging, the process should usually commence with this amount of current, and this rate should be continued until the voltage of the battery rises to about 2.5 volts per cell. The rate of charge should then be reduced to that equivalent to one-third of the discharge rate, and this should be continued until the voltage, which has fallen at the change to this new rate, again rises to about 2.5 volts per cell.

THE TEMPERATURE OF THE ELECTROLYTE

The temperature of the electrolyte during the charge should not be allowed to rise above 100 degrees, and if it should reach this point the charging should be modified either by reducing the amount of current going into the battery or suspending the charging altogether for a short period. When the temperature is high the final voltage of the cell will not be as high as when the temperature is kept within the most desirable limits, which are from 70 to 90 degrees Fahrenheit. If the temperature is kept high it will have an injurious effect on the plates by disintegrating them, and the rubber jars and separators will also be warped out of shape.

SPECIFIC GRAVITY OF THE ELECTROLYTE

The specific gravity of the electrolyte can usually be taken as an indication of the charge in the battery, and during the progress of the charging it will gradually rise to a maximum; so that where the battery is accessible enough to permit the use of the hydrometer a check may be kept on the voltage, and where a volt-meter is not at hand the hydrometer may be relied upon with safety, provided the electrolyte has been kept up to the proper standard. Due to fluctuations in the chemical condition of the plates and the loss through evaporation during the charging, the electrolyte will change its specific gravity, and it will be found necessary to rectify this by adding distilled water when it is too high, or a little acid if too low. It must be remembered, however, that this correction should be made when the battery is fully charged, and at least every ten days.

GASES GIVEN OFF FROM PLATES

At the start of the charging operation it will be found that no gas is given off by the plates, but as the charge advances this gas will increase, and towards the end there will be a tendency to give off a great quantity. Care must be taken to so regulate the amount of the charging current as to prevent this gasing as far as possible. The bubbles of gas in leaving the plates carry the active material away from the grid, thereby depreciating permanently the capacity of the plate to do its original amount of work and depositing this active material in the bottom of the cell, where it accumulates and eventually necessitates cleaning of the battery, which very materially adds to the cost of maintenance.

SIMPLE REMEDIES PROMPTLY APPLIED

Without going too deeply into the subject of the storage battery we may be justified in taking up for consideration the various remedies which may be applied when from accident, inattention, or abusive treatment, internal defects are developed. As in the care of draft animals, internal derangements are not frequent where a well regulated system of caretaking prevails, but let these regulations be neglected and trouble sets in only too quickly.

If the foregoing recommendations as to the proper and timely charging of the battery are adhered to, smooth and satisfactory operation will result; but presuming that from one cause or another the working capacity of the battery fails, immediate investigation of the cause, and equally prompt application of the proper simple remedies, will check further damage and restore a sound and healthy condition.

Although the diseases to which the battery is inclined are nearly as numerous as those of draft animals, yet the remedies to be applied are very few, and more or less of the homeopathic type. The application of the proper amount of current, a little acid or water, and considerable patience, will be the principal ingredients in the prescription for almost any disease. The first symption of defect is usually a decline in the capacity, or, in other

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words, decreased mileage, from practically the same amount of charging. Following a reasonable common sense process of inquiry, or analysis, it will not be very difficult to single out the trouble. The first precaution should be to ascertain if the trouble is local or general. It might so happen that a single cell was the cause, and so obstructs the process of charging or discharging as to impede the action of the other cells. A glance over the surface of the cells of the battery as a whole will very frequently reveal in a moment the cell at fault. The color of a defective cell will usually form such a striking contrast with its healthy neighbors as to very plainly bespeak its sickly condition. If the cause of this condition is not due to something visible, such as insufficient liquid, broken jar, or poor connection, it will require special individual treatment, as will appear further. If there is no superficial indication that one particular cell is the cause, and the peculiarity of the trouble should show that the defect was local rather than general, a more particular search can be made among the cells by testing their voltage individually with a volt meter. This will decide definitely whether the battery as a whole or only a portion of it is in bad shape.

SUMMARY OF FAILINGS

As the operation, or electro-chemical action, of the cells demands a complete unobstructed path or circuit for the current to enter the cell through the grid of the positive plate, from the grid to the active material compressed into or formed on the grid, thence through the electrolyte to the active material of the negative plate, and through its grid on into the next cell—any trouble which may develop in the operation of a cell will usually have for its cause obstruction or resistance in this circuit to the path of the current, and this applies to the quality or richness of the electrolyte. The grid may be broken, or not have sufficient connection with the other plates. The active material may not be in close contact with the grid. Or, the internal surfaces where the joint is made are covered with a composition whose conductivity is not very good. The active material may have become so porous as to have but loose contact between its particles, or these particles may have been surrounded or coated with the non-conducting composition just referred to, which is commonly known as "sulphate." Considerable of the active material may have been forced or shed from the plates. The liquid may be too strong or too weak, in having more or less acid in it. The active material may have accumulated to such an extent in the bottom of the jar, as to touch or connect the bottoms of the plates, and thus offer a different path for the current than through the electrolyte.

SULPHATION AND DISINTEGRATION

This practically sums up all of the failings of a well designed battery, and it will be conceded that the list is not a very long one. We may confidently assume that given a battery of cells properly assembled, with the plates in good condition, the electrolyte of the proper density, and suitable current to do the charging, we can store satisfactorily for future use the total energy which the battery has the capacity to transform.

Of the defects enumerated all, with perhaps the exception of disintegration, can be overcome at the hands of any intelligent manipulator. A fracture of the plate, or its imperfect connection with the rest of the battery, will be self evident. The density of the liquid can be measured with the hydrometer and easily corrected. The external sulphation of the plates will be indicated by the white, sickly color of these plates, and its removal can be effected by a continued application of a small amount of current. If the sulphating has been extensive, and has penetrated deeply into the active material, then a good deal of persistence in this treatment will be necessary. The disintegration of the active material is the most difficult problem of the lot. If this has taken place only on the surface of the plates it will cause no further damage than a decrease in the capacity of the battery until sufficient of this material has accumulated in the bottom of the cell to reach the bottoms of the plates. There is a limited space provided at the bottom of the jar for this accumulation, but when that space becomes filled there is no other remedy than to disconnect each cell and remove this material. If the disintegration has occurred internally in the acitve material it will appear loose and porous, and there is no effective remedy. This condition, however, will not often be found, and is usually the result of prolonged abuse.

In the charging process of a battery bubbles of gas are given off from the active material, due to the chemical change taking place. This gas in bursting from confinement carries away portions of this material with it, and if the gassing is excessive the disintegration will be greater. It is good sense, then, to keep down the gassing as much as possible by charging slower, and by charging the battery as seldom as possible, consistent with its use and the maintenance of its good condition. This will keep the capacity up to maximum and postpone cleaning.

WHEN BATTERIES STAND UNUSED

Sulphation is caused by discharging the battery below the proper point, or by discharging it too quickly; or it may be caused by allowing the battery when not in use to stand too long without recharging. When a battery stands unused there is always some leakage of its charge, and if this leakage continues the battery will be overdischarged. The effect which sulphating has on the active material is to render it non-conductive, and the sulphated material always occupies a greater space than before; consequently, when the sulphating takes place internally it has the effect of disrupting the entire plate by forcing it asunder by a bursting or expanding process. The sulphate itself may be removed by slow charging, but the disruption it has caused cannot be repaired. Therefore, it will be understood why this sulphating should be so rigidly guarded against. It permanently injures the battery if allowed to go very far.

When the cleaning of a battery cannot be deferred longer great care should be exercised to keep the expense of the operation as low as possible. Usually the fragile parts are handled so roughly that a large proportion of

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the expense is due to unnecessary breakage. It must be remembered that as every charge of the battery shortens its life there is gradually going on a process of deterioration, and this gradual decline in the usefulness of the battery should properly be regarded as analogous to its slow consumption of fuel. A point in the life of each plate is reached where it is no longer profitable to continue its use, because its active material has been so worn off as to make the relation between its weight and its serviceability such that the purchase of a new plate is more economical than the continued use of the old one. Consequently the cost of plate renewals and periodic cleanings should be charged to the cost of operation rather than to the deterioration of the vehicle.

In this manner the consumption of the battery plates is regarded similarly to the consumption of current for charging, because both items are actually used to move the vehicle. The battery, as a whole, at the end of each period is as good as the motors or the rest of the equipment.

Principles and Practice In Transportation by Motor Vehicles

An Outline of What Has Been Learned by Experience with Power Wagons in America

I—The "Best" Power Wagon
II—First Cost of Equipment
III—Saving in Human Labor
IV—The Life and Durability
V—Together With Horses
VI—Training of Drivers and Others
VII—A Factor in Business Control
VIII—Tires and Other Buffers
IX—Assortment of Vehicle Sizes
X—Load Capacity Ratings
XI—High Pressure Installations
XII—Garages, Public and Private
XIII—Trucking and Express Companies
XIV—Municipal Uses and Service Stations
XV—Public Service Work
XVI—Speed Checks—Control Instruments
XVII—The Agricultural Interest
XVIII—Traction Devices—Winter Wheels
XIX—Apprentices in Shops and Stables
XX—Accounts and Their Keeping
XXI—Steam Vehicles, Now and Later
XXII—The Sociological Side

[*Sections XII to XIV in this issue—Sections XV to XXII in following numbers.*]

XII

Garages Public and Private

DURING all the past years in the development of motor vehicles the profits for the owners of public garages have been distinctly in the foreground in everything considered in the arrangement of garage work, while profits for the owners of the wagons entrusted to their care have been not only in the background but considered as almost diametrically opposed to the interest of the garage men. It would be insanity to expect satisfactory results to the owners of trucks and delivery wagons under these circumstances. Yet such has been the pressure caused by the absence of information on the part of power wagon owners and by the scarcity of competent help for the proper maintenance of their property that probably one half of power wagon owners have actually had their vehicles cared for in just such public garages. With what results may be imagined.

The pleasure vehicle was in practically all instances the backbone of the garage business. The principal profits were derived from them and from the troubles caused by reckless, speedy and incompetent driving. The shortcomings in intelligence or character of the pleasure vehicle owners constituted the capital of the garage owner. He drew heavily upon it, and frequently overdrew. Matters of speed and racing formed the subject for the attention and talk of all the light-headed helpers in these establishments. The washers and often the drivers were recruited from messenger, elevator and bell boys, newspaper carriers and sellers. The tone was usually that represented in the lowest class of the press. According to it every automobile owner was a "swell guy" to be exploited. Considerations of economy did not thrive in such surroundings. There was no room for decent regard of the interests of customers occupying the exceptional position of operating motor vehicles for profit and economy rather than for elegance and ostentatious expense.

Now, that the motor vehicle users have nearly got through sowing their wild automobile oats, a change in the garages is following suit but the improvement is one in the decency of the tone rather than in the deepening of the understanding of economical principles. The lat-

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ter are still in constant jeopardy in the too close proximity to Tom's, Dick's and Harry's 50 horsepower, one-mile-a-minute touring car. Whatever progress has been made in the art of keeping trucks and delivery wagons in constant commission at a minimum of expense has been due to work initiated and tried out in private garages forming the maintenance stations for some large merchants' or corporations' installations of power wagons; although it should perhaps be admitted that a few rich men owning stables of 5 to 15 pleasure automobiles have contributed not a little by showing what a model garage for such vehicles may be made when cost is not considered. The improvements introduced in those few private stables of this character have doubtless suggested improvements fully available for the economical power wagon station.

As the pleasure automobile is still very much more numerous than the commercial motor vehicle and promises to remain so for considerable time the public garage gives little more promise for the future than it has redeemed in the past.

Owners of the commercial motor vehicles must look to the establishment of private stations if they shall hope to accomplish the best results.

Or, they must rely upon co-operating with other owners in a similar position with themselves for the maintenance of garages under competent foremen directly responsible to the various owners. Among public institutions that give any promise of equal results only two kinds seem worth mentioning. One is the power wagon garage operated by cartage companies who are fully accustomed to meet the business wants of their customers, and the other such garages as may be established here and there by the manufacturers of power wagons to watch over the welfare of the vehicles which they have sold.

As it is manifest that all garages must be made to pay, for their owners as well as for their customers, every step taken in the industry for enlightening garage people upon the best methods for rendering their institutions profitable by legitimate means is naturally in the interest of vehicle owners as well. It seems therefore a favorable indication that one of the manufacturers of electric vehicles has lately published a highly interesting pamphlet setting forth the manner in which electric garaging can be made profitable. It has been a prevalent opinion among garage men that more profits could be squeezed from the owners of gasoline vehicles than from those of electric vehicles but a peep into the inside of this opinion seems to reveal as the main reason for its existence little more than the prevalence of malpractice in creating unnecessary costly repairs on gasoline vehicles solely upon the strength of their owners' lack of information or reckless use of their own property.

Another indication of what may be done by the manufacturers connected with the motor vehicle industry is furnished in the case of one make of storage batteries for which repair stations with specially skilled help are maintained in nearly all of the large cities, invariably resulting in securing the lion's share of the electric garaging in each locality.

Altogether there is no denying that the arrangement of garages as well as the maintenance work to be undertaken in them are matters still in the infancy of their development, fully five years behind the evolution of the vehicles themselves. Gradually, however, information and skilled men are being produced in ever increasing numbers from the few places where the work is done well, and neither merchants co-operating with one another nor cartage companies should now have much difficulty in finding persons fully competent to oversee their establishments, while the small private station may in most cases be supplied with a competent man sent out from the factory where the vehicles there maintained were made.

How the arrangement of the garage should be and just how the work should be done in each case may not be said in all generality, but only in a series of complete descriptions and illustrations of power wagon stations actually in existence and conducted with more or less approximation to ideal results. Such descriptions and illustrations this publication will place before its readers as fast as the material may be gathered. Taking even the most advanced establishments of this nature as models, it is impossible not to realize that many features remain to be worked out before a finishing touch to true economy may be said to be accomplished. It is still too common to store electric vehicles "as thick as they will stand," and that such could be done was actually brought out as one of the excellent features in electric vehicles in an advisory article appearing recently in a commercial vehicle publication, notwithstanding that inspection and adjustment at the right time become a practical impossibility unless each vehicle has its own allotted space with a sufficiency of room around it. The two-story garage has been developed in Europe to a finer point than here, it seems, and matters of insurance and of real estate economy remain to be looked into more closely than so far has been the case. One highly important point, namely, the right equipment with machinery and tools according to the nature of the installation, has so far apparently been left to a purely haphazard judgment without any attempt at systematic calculation of the chances and probabilities.

The equipment with spare parts for replacements, while perhaps the most vital detail in the arrangements of the private station, is necessarily a matter in which a garage owner, as such, could not be expected to interest himself, if he has vehicles of many different lines of manufacture under his care. It is mentioned here on account of its supreme importance for keeping power wagons uninterruptedly at work and because, in providing for an installation, it is one of those features requiring some correspondence with the makers of the wagons. The manufacturer knows, as a rule, in what order, approximately, wearing parts will require replacement, and will supply the spare parts with the machines if requested to do so.

All of these considerations will require interchange of knowledge, experience and opinions between power wagon users and foremen of installations during the next few years.

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XIII

Trucking and Express Companies

NECESSITY being the mother of invention, whatever there is of invention in using power wagons right, in devising and following the system that will get the maximum of profits out of them, must crop out sooner or later in the business of express and trucking or cartage companies, since economy is vital to their commercial existence. All the profits they make must be made out of transportation as such. Compelled to make profits, they *will* make them; and it will be the privilege of other power wagon users to observe and note what these professional transportation companies do, in order to learn with the least possible exertion how to obtain the maximum results from their own installations.

Those among the express and trucking or cartage companies who have discovered the power wagon, in the sense of appreciating the role it must play in their finances, having once adopted it stick to it and gradually extend its employment into more and more branches of their service. No better proof of the power wagon's intrinsic economy even at this early stage in the art of maintenance could possibly be offered.

Mentioning examples, it may be recalled that the Parmelee Transfer Company of Chicago adopted electric vehicles in that early stage when neither the batteries were perfected nor the art of caring for them known. Naturally the results were poor, and the vehicles, if memory serves us right, were scrapped. After a lapse of a few years, however, the same company has returned to power wagons under better auspices and continues to use them. Another Chicago express company, the Brink's, braves the pavements of the western metropolis with gasoline wagons and liberally proclaims their superiority over the old system. The Adams Express Company has for years experimented with modified constructions of all types of power wagons, steam, electric and gasoline, and now uses large gasoline trucks in some branches of its service and a much larger number of electric express wagons in a number of different cities of the country, apparently with extraordinary economical results. The United States Express Company has for the present declared in favor of electric wagons for the bulk of its work and seems particularly partial to the use of Edison batteries although the latter cannot be said to be openly in the market.

In the case of all the express companies, when the question comes to the equipment which they use, there seems to be cause for great caution in drawing quick inferences for the reason that these large corporations are intricately entwined with other large corporations whose financial interests may dictate the use of one equipment rather than another without strict regard to intrinsic merit. Other power wagon users will therefore find it the part of wisdom, rather than to follow the example of any one express or trucking company in regard to types of vehicles or vehicle equipment, to obtain general information in regard to what all of them use in their various branches of business respectively, and to draw their conclusions accordingly.

One of the stumbling blocks to immediate success in the efforts made by large companies for adapting the power wagon to their wants has arisen from their corporate complications. Occasionally they have fallen victims to engineers with pet theories who manage to impress one director or another; or nephews of the vice president's sister-in-law have been appointed to jobs for which they were not fitted. Complaint of this peculiarity in corporate management of new branches of work has also been voiced strongly from England, where it seems to have been more prevalent than here. It soon yields to heroic treatment, but frequently has interfered with the economy of large corporations during the first period of their use of power wagons. It seems to be common to consider, in these circles, that a nice young man properly graduated from a technological institute and well connected socially is just the person to place in charge of such a new branch of work as the investigation and organization of a power wagon service, but the natural leanings and longings of this class of men has been abundantly shown to tend toward experiments in construction, toward a chance for glory rather than toward a certainty of economy, and the companies have had to pay.

In the 6,300 trucking and cartage companies operating throughout this country the field for the employment of power wagons is so immense that the industry can contemplate with complacency the loss of a few through such causes as indicated. At all events, there is always in each case a quick return to sound business principles as soon as the ledger shows what the favored young man of Titanic ideas costs.

The absolute necessity for making profits from transportation alone in the express, trucking and cartage companies, to which may be added in a slightly different sense the omnibus, stage and cab companies, suggest strongly to the power wagon industry to cultivate this line of customers more assiduously than any other. Self-interest competently directed will compel them to aid the manufacturers all they can, not only in regard to construction details but especially with regard to systematizing the methods of maintenance, and they cannot avoid spreading the required knowledge of driving and stabling methods among large numbers of employes, who will afterward carry the knowledge into wider circles and prevent other power wagon users from falling into bad ways. The start being already made in a highly auspicious manner by the largest companies of this character, there can be little doubt that competition will quickly force prac-

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tically all of them to look into the power wagon question and to place extensive orders with the industry. In this prospect there is outlined perhaps the most ideal plan for safety combined with progress, inasmuch as the industry, as at present constituted, will have all it can do in supplying vehicles for these companies alone, as soon as they shall all have waked up to the new necessity in their business.

While believing that the transportation companies for natural causes will be the first to lay solid foundations for power wagon use in general, and—speaking mainly of the maintenance of gasoline vehicles and steam vehicles since electric practice is already well developed—in all probability will be so far ahead at any given time on questions of economy and means for getting efficiency under specially difficult conditions, as to be able to offer their services to individuals to mutual advantage, there is no inclination to underrate the fact that in the aggregate the much larger number of brains among the merchant class will contribute a most valuable share to the common experience, especially in details relating to each of the numberless different forms of business in which the power wagon may be used.

Selecting, however, any one class as the most important customers, allies and friendly critics of the power wagon industry, the choice should fall on the transportation companies.

XIV

Municipal Work and Service Stations

NEARLY everything that concerns the use of power wagons by municipalities for any other work than that of the fire department and the light rapid work of inspectors in the police and other departments lies in the future, and, as it is doubtful whether municipalities as a rule are bent upon labor saving or an excuse for labor extension, it is perhaps not to be expected that power wagons will be used extensively in any of the heavy and comparatively slow work which abounds in the sphere of municipal activities and ought to abound more.

The work of inspectors is done with ordinary automobiles and falls under that branch of power wagon service, but that of the fire departments is both heavy and fast, and the adaptability of self-propelled vehicles for it has attracted widespread attention followed by practical results. The economical side of it is thoroughly eclipsed however by the importance of reaching fires a few minutes earlier than possible by other means and of having the mechanical power of the vehicles at disposal for increasing water pressure and thereby sending streams of water to greater distances and greater heights.

The advancement made in Europe in the way of devising suitable self-propelled fire-fighting apparatus has been much more general and generous than here. The Vienna fire department is operated by self-propelled vehicles practically exclusively and the reports which have reached this country indicate a saving in the cost of the service which should immediately attract attention in every municipality where the question of cost is seriously considered. The reports of efficiency are still more favorable. In Paris, London, and in a number of towns in Germany electric, steam and gasoline driven fire department vehicles have been used with varying satisfaction for several years and, while the reports indicate continual changes in the construction looking toward better adaptation to the peculiarities of the work, they also indicate that any one of the three types of power may be used to advantage so far as efficiency is concerned. In most places these vehicles are supplemented by the machines of the old system and an economical comparison is therefore practically impossible.

In most fire departments in the United States it is the ambition of the chief that his men shall use their ample leisure for keeping the fire-fighting apparatus in the pink of condition, and as the equipment includes chemical engines and a good deal of machinery bearing strong resemblance to that of the power wagon, more or less ingenuity and familiarity with ordinary repairs of mechanism is developed in the fire crew. This skill may of course be turned to account for the maintenance of self-propelled vehicles, and it should therefore be possible not only to reduce the maintenance cost to a minimum in the fire departments but also to keep its standard up to a very high level, with minimum of outside repairs As a mater of fact, a large number of cities and towns in the United States are at present receiving estimates upon the comparative economy of the old and the new systems and generally seem to favor the innovation. A few of the manufacturers have also turned their attention in this direction and are offering nearly all the different types of vehicles required. The same may be said of self-propelled street sprinklers, and where accounts have been kept of the performances of the latter a considerable saving has been figured out. So far as known, however, the self-propelled street sprinkling carts are in all cases owned by the contractors who do the work and are not strictly included in the municipal system.

Much the widest employment of power wagons for municipal work would be that usually sorting under the street cleaning or engineering departments and relating to the removal of street sweepings and refuse and offal from the houses. But in this line absolutely nothing seems to have been done so far in this country although the city of Liverpool has used steam dump wagons for

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many years and is continually extending the service, and is imitated among other European towns. The extreme slowness which has been characteristic of the work of the ordinary wagons of this type and the necessity for exceedingly frequent stops are factors which seem to have militated strongly against the idea of employing motor power, but in reality these considerations should operate in the opposite direction, as the question of construction involved in fitting power vehicles for that class of service are by no means difficult of solution, once the problem is tackled.

For various reasons the majority of the dump carts used in street cleaning departments are drawn by one horse and its size and weight is selected with reference to its capacity for drawing a load of 500 to 1,000 pounds at a very staid gait which is not changed greatly when the empty wagons return to the loading places. Power wagons of suitable construction could profitably be made to carry 2 to 3 times as large a load as a one horse cart and to proceed at twice the speed, and with these large margins of superiority at the two most essential points, namely loads and speed, it should be easily practicable to figure out a substantial economy. The main difficulty would seem to lie not in the technical question but in overcoming the inertia of the municipal administrative machinery as well as the popular opposition to anything reducing the employment of human labor in public work.

An important point in the municipal work with power wagons would be the possibility for working at night with noiseless rubber tired vehicles, thereby reducing the number of the latter very considerably and saving valuable space in the service stations, as well as saving the population a good share of the annoyance now caused by the customary methods of executing street cleaning and renovating work. It should perhaps also be mentioned that the new facilities which would be placed at disposal by power wagons for reaching out from the center of cities, very much farther than before, would open up new possibilities in the way of disposing profitably of all sorts of refuse. Neither does it seem excluded that cities in some cases might undertake to remove dirt and rock from excavations by means of power wagons, working at night perhaps, dispose of such material at a profit instead of having it dumped at the nearest available spot, in river or sea, where those who own the material must frequently—as for example in New York City—pay for the privilege of getting rid of it.

While this look into future possibilities is based wholly upon experience with power wagons in work not municipal and is therefore in a sense theoretical, one additional important factor in favor of extending the municipal employment of motor vehicles should probably not be left unmentioned. The service stations or municipal garages could easily and economically be made of such a model character as to become the centers for spreading knowledge in regard to the care and maintenance of power vehicles throughout the city were located.

Unfortunately, however, all questions of economy, where municipalities are concerned, are somewhat confusingly mixed with the chances—varying locally—for securing the kind of administration which will make for public saving rather than for private profits.

Whether manufacturers should cater to private profits or to public requirements is a moral question not within the province of this publication, but, as to the public requirements, it has appeared on several occasions that one of the principal hindrances against the introduction of power wagons for street cleaning work has sprung from the peculiarity that the chiefs of departments were not in possession of any definite plans or drawings showing how it was proposed to apply motive power to wagons of the established type of body, nor of any general plan showing how vehicles of different body design might be used.

The problems of the work have not yet been attacked seriously by the industry.

MOTOR DELIVERY WAGON IN DENMARK

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Scrap Book Records for Wagon Owners

PRESS REPORTS OF ADVANCEMENT IN THE USE OF POWER WAGONS IN AMERICA—WITH COMMENTS

IN FIRE FIGHTING WORK

NO phase of the adaptation of the automobile principle to various municipal uses has attracted more attention than its application to the engines and other fire-fighting apparatus which make up the Fire Departments of the larger foreign and American cities. All the three accepted forms of propulsion—steam, gasoline and electricity—have been adopted, and the fact that the extra power required to operate the driving motor may be used to reenforce the pumping outfit when the scene of the fire is reached renders the motor fire engine particularly effective.

Another important advantage of self-propelled fire-fighting vehicles of all kinds over the horse-drawn wagons is the saving. Engines, trucks, salvage wagons, hose carts, etc., lie in their various stations 85 per cent of the time. If of the horse-drawn variety the cost of horses' maintenance continues uninterrupted, not so the motor fire-fighter. Whether of the electric, steam or gasoline type, the expense of maintenance while in the station is practically nil. That is one excellent reason why ultimately the horse's place as a fire-fighting adjunct will be entirely superseded by the motor.

Not alone in the lower cost of maintenance are motor fire engines, hose-carts, trucks, etc., demonstrating their superiority over the horse-drawn wagons, but the saving in time effected by the use of the former is considerable—and a minute or two often means a great deal in the early stages of a fire.

In a mile run the total saving of time in actual experience averages two minutes. For the use of the department chiefs, for hose wagons, salvage wagons and the lighter apparatus the use of gasoline motors is specially indicated, by reason of the ease with which speeds up to 30 miles may be attained and maintained.

Ease of control is another factor in favor of the motor fire-fighter. Speed may be maintained almost to the corner where a turn is to be made, and once around a corner the maximum speed is more quickly attained. When quick stops are necessary, by reason of a congestion of traffic, the motor wagon has a marked advantage over the horse-drawn vehicle. Actual tests along this line with engines of equal weight and traveling at an equal rate of speed have demonstrated that the motor can come to a full stop in less than half the distance required by horses.—*Philadelphia Record.*

[Having 85 per cent of their time at disposal for care and maintenance fire departments should be able to keep their equipment in the pink of condition all the time, and the men should naturally develop into motor vehicle inspectors and repairmen of the first order—provided there are no ulterior purposes to be served in having repair work done by favored shops on the outside.]

* *

OUSTING STEAM ON RIVERS

OPERATORS of steam boats on the Ohio river assert that they will be run out of business unless the government subjects gasoline motor freight and passenger boats to the same restrictions as are imposed upon them, says the *Louisville Courier Journal.* Complaint has been entered in court by Capt. W. H. Crammond, of Hawesville, Kentucky, the charge being made that several of the gasoline boats now in operation are over fifteen tons capacity and should be subjected to the rules regulating craft of that capacity. It is charged that these boats are operated both in the passenger and freight trade. No inspection whatever is made and the men who operate them are neither licensed engineers, pilots nor captains. It is charged that one boat in the excursion business carries over 100 persons a trip and not a single life preserver is aboard.

* *

THAT TRANSMISSION SYSTEM

SEVERAL months ago the Burlington sent Max Tolz, a motive power engineer, to Europe to study the motor car question. After spending six months in Europe the engineer returned with a strong recommendation in favor of the steam motor car as the most economical, dependable and successful type of car in Europe. The Burlington therefore has adopted the suggestion of the engineer.

The Union Pacific has actually put several cars of its own into use, and the Alton is preparing to try out an electric motor which it has about completed. The Pennsylvania is also experimenting with several sorts of motors, and the Strang Co., makers of the type of car which recently passed through Cleveland, has a number of cars at work on twenty miles of railroad which the company owns in Kansas.—*Cleveland Plain Dealer.*

[When the railways look for motor car systems and decide on steam, as in the case of the Burlington and the Erie railways, and when most of the other railway companies adopt gasoline motors in conjunction with the electric transmission system, the inference is clear and fully corresponds with the experience gained in Europe. The decision is in no case against the gasoline motor. On the contrary, it is endorsed by those who adopt the gasoline-electric system. It is the sliding-gear transmission which is considered incompatible with railway service, because it demands a certain amount of special skill on the part of the operator, or it is the transmission by friction bands or segments to a planetary mechanism which is condemned on account of the occasional need of adjustment for wear while *en route.* The position of the transmission mechanism underneath the railway motor car body and the imperative necessity for uninterrupted travel on a schedule of time, are the factors which make the transmission question look differently to a railway manager from what it does to a truck owner. The latter may reckon on some skill in his drivers and a stop for adjustment once in a while does not materially affect the truck's value as a business adjunct.

Many are at work, however, to devise a mechanical transmission system to be used with gasoline motors in railway cars. The prompt adoption of the electric transmission does not seem to indicate that sanguine hopes are entertained in regard to immediate results of these efforts, but when finally they shall have been crowned with success, the power wagon, too, will be the gainer].

* *

HORSEMEN NOT WORRIED

TABLES compiled from Government reports are printed to show that the automobile has not produced as yet even the beginnings of a horseless age. In 1905 there were 17,057,702 horses in the United States, as against 14,213,837 in 1890. The export price averaged $308.99 last year, as against $174.50 in 1892.

These figures appear probably more surprising in New York City, which is the country's greatest automobile center, than in sections where the motor vehicle is still much of a curiosity. There may well be a general wonder, however, over the fact that no trace appears in the horse census of the advance of the trolley forces, which antedated the coming of the automobile. In this city alone nearly 15,000 horses were displaced by improved methods of street car transportation, and the total displacement in the United States must have been enormously large.

Of course, the automobile has not yet come to its full strength in competition with the horse. It will have an era of lower prices, its cost of maintenance will be reduced and it will be the prevalent vehicle for trucking and delivery in the cities at an early day. Horsemen, however, are not worried. They declare themselves confident of the future as they are sure of

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the present. The figures given seem to justify this confidence. They point to trolley and motor progress as promoting a sort of evolution—the survival and increase of the fittest of the horse species.—*New York World.*

[Perusal of the first article in *The Power Wagon,* of March 15, will furnish the solution to the riddle which puzzles so many, viz., that the number of horses continues unabated from year to year, despite trolleys and motor vehicles. In brief, the natural increase of the population and of its demands, combined with the statistics of the motor vehicle industry, fully explains the seeming contradiction].

* *

UTILITY OF SPEED RECORDERS

EVEN the drivers of ordinary automobiles are beginning to realize that on tours it is the average speed that counts, not only in the matter of reaching the destination within a given time but particularly in reducing the cost and chances involved in repair bills to a minimum. Spurts are apt to result in derangements that will reduce the average speed, and thus the motor car has some points in common with the horse which also does its best work when not over-driven at any time. Truck and delivery wagon owners are probably more interested than anyone else in fitting their vehicles with reliable devices for measuring and recording the speed at which the vehicle is operated at any time between morning and evening. Extraordinary high speed at any one time with a loaded truck probably results in more injury to the mechanism than is compensated for in the advantage gained, and drivers cannot be too strongly impressed with this fact. None of the reasons which argue in favor of a well-maintained average speed can excuse the short spurt which subjects the vehicle to intense strains without any corresponding time or labor saving. It is the strain which exceeds the "factor of safety" that costs money, rather than the continuation of moderate stresses well within the safety limits.

* *

A communication from the Board of Public Safety in Alliance, Ohio, to the City Council states that the cost of equipping two sub-firestations and maintaining them for one year amount to $23,625.00 for the installation, and $5,940.00 for the maintenance for one year if the customary equipment drawn by horses is used, but to no more than $21,600 first cost, and $3,840 for one year's maintenance, for self-propelled fire-fighting apparatus.

The Barnum & Bailey circus people are negotiating with a Pontiac, Mich., firm for trucks to be used in the transport of their wild animals.

SCRAMBLE FOR GASOLINE RAILWAY CARS

FOR the last five months the St. Louis Car Company has had in process of construction a novel type of motor car for the Missouri Pacific & Iron Mountain System. The car is seventy-eight feet long and is propelled by a gasoline engine. The fore part of the car contains the machinery. The second compartment is used for baggage. The end compartment is arranged for passengers.

The Strang gasoline-electric motor car, which was in St. Louis a week ago, and the Union Pacific motor car, which visited Alton several months ago, are built only for passenger business. The Missouri Pacific car is unusually long, and is constructed for both passenger and light-freight business.

The Missouri Pacific motor car has been built by the St. Louis Car Company, under the personal supervision of General Manager Sullivan of the Missouri Pacific and General Manager Vogel of the St. Louis Car Company. It is now nearly finished, and will soon be in condition to make its first trip.

The car will be used, if successful, on branch lines. All the great roads are looking for a practical auto-motor car for this service. With such a car it will be possible to give better service on branch lines, and to manage this traffic more economically.

The Alton is having six new gasoline-electric cars constructed at its shops at Bloomington. The Wabash is not experimenting, but is in regular communication with the Baldwin Locomotive Works regarding a car which is being built.—*St. Louis Republic.*

* *

EXAMINATIONS IN DRIVING CAPACITY

SEVERAL automobile drivers are employed by the City of New York in the various municipal departments. When there is a vacancy to be filled the applicants must pass an examination intended to show their degree of familiarity with the work. At one of the recent examinations of this kind, the following questions were to be answered in writing:

1. What is the difference in construction between the air-cooled and the water-cooled motor, and what attachments or extra parts are necessary for the operation of either type?

2. Describe as clearly as possible exactly what takes place in the cylinder of a four-cycle motor during one complete cycle, including the necessary operations of valves, ignition on the car and use of spark plug, etc.

3. Describe the construction, location and use of (a) Coil; (b) Commutator; (c) Spark-plug.

4. Describe in the same way the construction, location and use of (a) Circulating Pump; (b) Radiator; (c) Muffler; (d) What effect has cutting out the muffler on the engine?

5. What are the most important parts of the engine to be lubricated? State fully what points are to be looked to in regard to kind and amount of oil used and care of lubricating devices.

6. (a) State all the points to be looked to in taking supply of gasoline; (b) What special care is necessary with the water circulating system in cold weather?

7. (a) What care should be taken in changing gears starting and reversing; (b) How is the speed of engines regulated while running and why does this regulation cause a change of speed?

8. What brakes are there on an automobile? Describe how each one acts and what is its special use.

9. State in detail everything you would do or see to in preparing an automobile in your care to take out on the road and in getting under way.

10 and 11. Write a short account in the form of a report to the owner describing some accident to the engine or machinery of the car in your charge, and how you repaired the same.

12. What are the city regulations in regard to speed and lamps, covering automobiles?

13. Draw rough sketches showing the proper course of a vehicle in turning from one street into another (a) to the right, (b) to the left; (c) also what other general rules should the driver of a vehicle always observe?

Drivers should no doubt know most of the things asked for in these 13 points, but to express it would probably prove a difficult matter to some of the very best applicants. If the City of New York received any satisfactory paper, there are 21 automobile publications in which the applicant who wrote it would be entitled to a job on merit alone. They are looking for just such men.

* *

CINCINNATI'S TRUCKS ON PARADE

THE committee of the Business Men's club on street improvements and cleaning in Cincinnati is making preparations for a great street parade to be held the second week in April, at which time one of the features will be a "mechanical parade," composed exclusively of machinery, the word being used in an extended sense. Four or five bands of music will be mounted upon electric trucks, and all the owners in Cincinnati of electric, steam, or gasoline delivery wagons or trucks have been requested to allow their machines to take a place in the parade, either empty or carrying the participants. One of the objects is to suggest in a picturesque manner the value of mechanical vehicles for keeping the streets clean.

* *

In the very near future the Deere & Clark Motor Car Company, of Moline, Ill., will enter upon the manufacture of large gasoline trucks. The first truck will be furnished with a 20 hp. twin-geared engine, whatever that means, says *Moline Mail.*

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Traffic by Motor Power in Europe

MAINLY A DIGEST OF THE BRITISH AND CONTINENTAL TECHNICAL AND CLASS PRESS

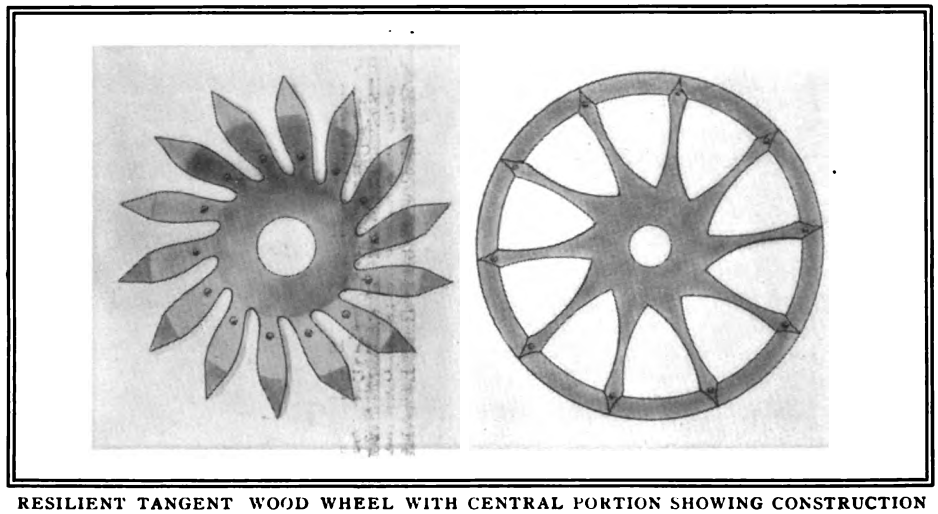
STEEL TIRES FOUND WANTING

FRANTIC attempts to introduce freaky looking spring wheels in order to get elasticity into the iron tires with which the British heavy power trucks, especially the steam trucks, are usually shod, bear witness to the shortcomings of the unresilient tire in comparison with the rubber tire, the cost of which is causing so much squirming. Recently the British owners of trucks and particularly the operators of omnibus lines have seen the light of true economy somewhat more clearly than before. They have discovered that the iron and steel tires lose money for them by preventing their wagons from attaining a profitable rate of speed. This belated but important discovery has not yet fully convinced them that the rubber tire is the most economical tire to use, everything considered; and in fact, it may be doubtful whether the rubber tire really is as necessary and efficient under a 10-ton load driven at 6 miles per hour over smooth and hard roads as they are under American conditions. Their attention is still turned in the direction of spring wheels but not with great hopes of success considering the many failures, but constructions such as that of the "Pedrail," mentioned in another column of this paper, attract the attention of those not strongly opposed to what is radical and extraordinary. To the majority the very simple resilient wheel constructed under patents of Mr. Thomas Gare, of Liverpool, is much more attractive, and this wheel seems to be making considerable progress among truck users as well as for trollies and other constructions which suffer from road vibration. After extensive tests in connection with omnibus service it is said that the advantages to be derived from the use of the Gare wheels are not limited only to the reduction of wear and tear upon the motor vehicles but are shown distinctly in the material increase of speed without accompanying noise. In the business of the "Pickford Limited" comparisons were established between the amount of work done by its tractors which were equipped with resilient wheels and those equipped with ordinary traction engine metal wheels. There was a gain of more than 50 per cent in the speed of the machines and the noise from the faster ones in no single case gave rise to complaint. The "Pickford Limited" who are well known carriers and forwarding agents, have been using the Gare wheels since the summer of 1904 on their steam tractors, and their whole motor plant is now being converted to wheels of this description.

Mechanically the most important feature in the construction of the Gare wheels is the adaptation of the tangent principle, so well known from the wire suspension wheel of bicycles and traction engines, to wood construction. The accompanying illustrations show the central portion of a hub to which the spokes are fitted, as well as a complete wheel. The various stages in the construction of a wheel for heavy truck purposes to carry a weight of 4 tons are as follows: The rough plank of oak is first of all taken to a large circular saw, where it is cut into quarterings, or scantlings, suitable for the size of the particular spoke which is to be made. The spoke is next passed over to a band sawing machine, where the front face is contoured. From there it is taken to a tool, which gives the proper sweep to the spokes. The correct angle for the top and bottom wedge-shaped ends of the spoke is then made by passing through a so-called tanging machine. After the necessary number of spokes have been made for a wheel—twelve for the front wheels and fourteen for the back wheels—they are slotted at their bottom ends to take a 3-16th inch circular steel plate, about fifteen inches in diameter, which forms a central strengthening web for the inner ends of all the spokes, as well as keeping them in alignment. The completed central portion of the wheel is afterwards taken to a machine which cramps up all the spokes, and makes them bed against each other, after which they are forced up on a wheel lathe. Segmental pieces of ash, forming the felloe, are then cut to fit in between the V-shaped ends of the spokes, but, first of all, two pieces of rubber, 1-4 inch thickness, are firmly cemented on to each face of the V-shaped end. A steel rim is afterwards shrunk on, and this forms the base for the tire which is intended to be used.

For heavy work the manufacturer makes a tread which is composed of a number of square steel grids, cast to fit the diameter of the wheel upon which they are to be used. The grids have nine cells each, into which are fitted the same number of rubber blocks. The required number of cell units are then securely fastened to the felloe by means of bolts passing through two steel rings, which are attached to the inner and outer sides of the felloe. A tread for lighter work is also manufactured which consists of two steel channels of U-section, placed side by side on the wheel rim. The channels are filled with alternate blocks of rubber and oak, and a special cement is then paid over the tread, and forced into the interstices.

The company makes various types of wheels suitable for light cars, and horsed vehicles, and, in addition, is making a feature of small wheels, specially designed for trollies.



RESILIENT TANGENT WOOD WHEEL WITH CENTRAL PORTION SHOWING CONSTRUCTION

"For motorbuses," says *"Commercial Motor,"* "these wheels may prove to supply a want which is making itself felt every working day to the omnibus engineers,"

* *

MONKS TO RUN BUSES

MONKS of the Grand St. Bernard will soon make their debut as chauffeurs. After a struggle lasting over a year they have received the permission from the Valais and Italian authorities to run a motor car service between the hospices of Grand St. Bernard and Simplon—their properties—and Demodessola and Aosta. The chauffeurs will be chosen from the monks themselves, who will wear cowls.

The cars, which are being specially constructed to climb the steep gradients, will at the beginning be employed for the transport of supplies only.

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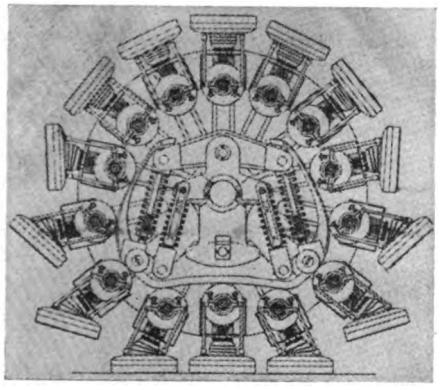
DIPLOCK'S WALKING TRACTOR

WHERE roads are bad or none exist, or where the climatic conditions in the winter and spring interfere somewhat with the traction from ordinary rubber tired truck wheels, the users of power trucks frequently complain that periods of idleness for the causes referred to detract materially from the economical value of their power truck service. It is noted, however, that the complaints emanate mostly from those users who place their vehicles in public garages and have no one in their employ endowed with the least mechanical ingenuity. When the well-known tire chain device fails to yield results the truck is put aside as if nothing further could be done to keep it in commission on the soft roads. On the other hand, it is usually admitted by those power wagon users whose experience has been most satisfactory or who are constantly compelled to overcome the difficulties of bad roads, that the matter of securing traction is under all circumstances a detail which is bound to be disposed of with increasing experience, and that in fact, an owner or driver with some little ingenuity can always keep his vehicle going even though the trade does not offer any particular device intended to meet his wants.

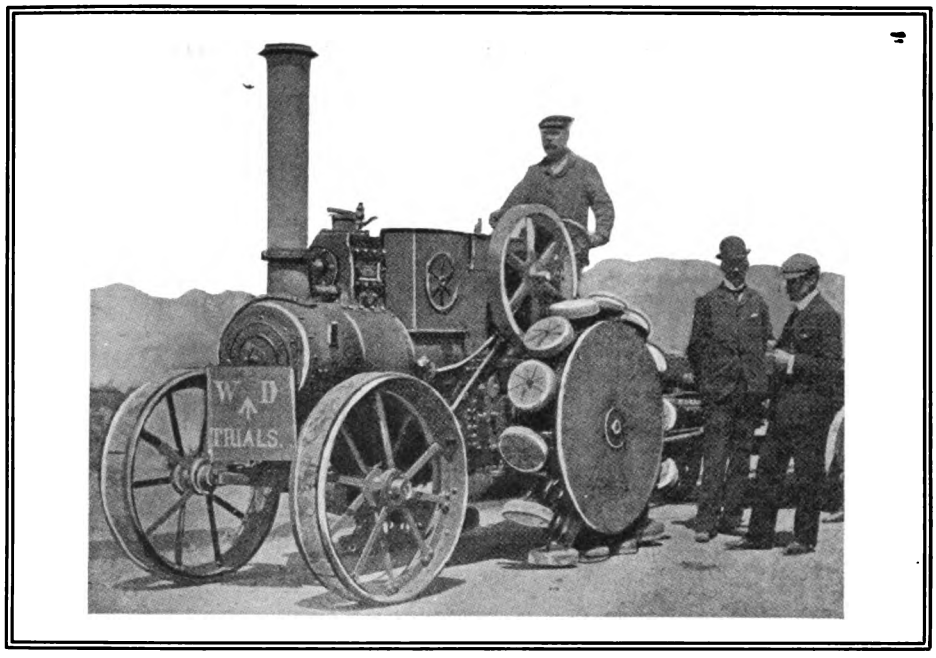
In England where the lorry of very high tonnage-carrying capacity and running on iron wheels is in common use, and where therefore more difficulties with traction are encountered during the season of ice and snow, many radical attempts have been made to produce wheels which would pass over obstacles or over soft ground



SECTION OF PEDRAIL WHEEL

with perfectly satisfactory results, and in that country another stimulus to such construction is furnished in the fact that the numerous colonies of the mother country afford an interesting market for road transportation vehicles of heavy caliber while not offering any roads worthy of the name.

Among the constructions referred to, one known as the "Pedrail" invented by B. J. Diplock drew very much attention several years ago by its strange and remarkable performance in "walking" rather than driving over heavy timbers and other



ENGLISH TRACTOR MACHINE WITH SPECIAL DRIVING WHEEL

obstructions placed in its way, and by its successful transit through morasses and over loose sand; and as well the English as the German governments after those trials singled out the construction as one probably specially adapted for war operations in the colonies. The accompanying illustrations give a good idea of the construction of the wheel. It resolves itself into 3 elements, the inner rail, the circular revolving box or wheel, and the sliding spokes and feet. These feet are disk-shaped pieces, 9 inches in diameter, soled with segments of rubber separated by strips of wood. They are attached to the sliding spokes by ball and socket joints, and these joints are lubricated by a mixture of tallow and black lead which has been found to keep them in perfect working condition during 12 months of activity. The central revolving box is arranged to be lubricated from one oiler which gives lubricant to all the working parts. The wheel center is made up of 2 disks bolted together, forming guides between which the spokes may slide. Each spoke is fitted with a roller, with a spring friction clutch in each roller. When the foot strikes the ground the spring friction yields, and what might be called the ankle joint allows the foot to accommodate itself to the road surface, the spring mechanism bringing the foot back to its normal condition when it leaves the ground. The rail is a piece of steel shaped as shown in the drawing and hung on helical springs from the central casting on the axle. In the latest design of this construction the rail is pivoted in a block free to slide vertically in the slot cut in the lower part of the casting attached to the axle. When the feet underneath the wheel take the weight of the vehicle they tend to push the rail and its pivot block upward in the slot, and if the wheel be rotating the reaction from any obstruction lying in its course will cause the forward roller to press the forward corner of the rail still more in an upward direction, making it turn in a vertical plane around its pivot, the turning movement being kept in check by the powerful helical springs. "Owing to the universality of the ankle joints," says *Motor Traction* on this subject, "the feet accommodate themselves to inequalities in all directions and it is a very pretty, if somewhat quaint, sight to see the wheel walking with one foot bending to one side while the next foot on some other surface inequality bends in the opposite direction. Walking along a slope the feet are equally happy and sure." In one of the trials a small "Pedrail" tractor carried a gross load of 17 tons over boggy and steep ground.

Probably the "Pedrail" represents the greatest extreme in elaborateness and quaintness of construction designed to permit the power truck to cope with extraordinary surface conditions. It can walk up and down stairs and up and down steep sand hills, but in commercial practice no truck will be required to do such "stunts," and the wheels or devices which may in places be required temporarily to take the place of ordinary wheels or tires for commercial work will undoubtedly be proportionately simpler in design, and immensely cheaper in cost of production.

* *

It is reported from Sacramento, California, that the California Northwestern Railway will soon inaugurate a motor car service on its lines in the vicinity of Santa Rosa. The object is to connect the various small towns of the vicinity and thereby meet the competition of the electric railway which operates hourly in all directions out of that town.

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TRUCKS FOR THE MINES

Military tests, both in this country and on the continent, have demonstrated the ability of the vehicle to withstand the hardest wear and the roughest usage, under heavy loads. This meets the conditions needed for work in mining districts that border on the inaccessible. The main item of cost, also—the necessity for rubber tires—has been eliminated. Thanks to better design and workmanship, and to more perfect material, the driver no longer goes with a pocketful of string to bandage broken parts, and a clothes basket to pick up the bolts and nuts, etc., shed by the wayside. Engines and frames, the chassis complete, are now stout enough to carry, on solid tired wheels, heavy loads over unusually rough ground, and powerful enough to haul gross loads of some seven tons or so up gradients, say, of one in eight, and to extricate themselves from soft ground, into which they may have sunk nearly axle deep. Do mining companies appreciate the potentialities of such Titans? Do they recognize the extension of operations and the cheapening of costs offered by the employment of this up-to-date method of transport?

There has been a certain shyness, an element of doubt that might now, in the face of accomplished facts, be well dispelled. In many cases, of course, the fuel question has been a difficulty. But the motor wagon of today offers the alternatives of wood, coke, coal, alcohol, petroleum, or heavier oils. One or other of these is generally within command, since the consumption is moderate. Reckoned at a speed of about six miles per hour, six to seven pounds of water and 12 to 18 pounds of coke per hour will place a 30 to 35 horse power five to six-ton steam lorry at the owner's disposition; while, for the gasoline wagon, rather over half a pint of gasoline per horse power per hour will suffice for the motor.

Obviously, the most attractive field for motor transport is not among large and wealthy mining concerns, equipped with tram or mineral railways, but among such properties as, by reason of heavy freight charges, are struggling for existence, and among those of which the value is not sufficiently proved to justify large capital expenditure on the betterment of communications. Dozens of mines in South America, Mexico, the States, South Africa, India, and the British Colonies might be instanced in which the introduction of motor vehicles might turn the balance between loss and profit. Particular instances may well be left to the experience of every mining engineer; but, as one of many cases, might be cited the Concordia mines of North Argentine. These undoubtedly rich mines, reputed to resemble the celebrated Huanchacha, were abandoned by the English company, mainly, if not solely, owing to the excessive cost of transport to the railway terminus at Salta.

For this property, the possibility of motor transport was realized too late. To indicate another direction of ultilization: where a group of mines is under one control, supervision, and, if need be, the rapid transfer of artifices, repair parts, etc., would be expedited were motor locomotion at hand. At a past meeting of the Nile Valley Mining Company, Mr. Norton Griffiths, one of the company's engineers, stated he could cover 80 miles to the mine easily in a few hours on his motor—a valuable economy of time.

In this direction, even the use of the pigmy in the category of automobiles, the motor cycle, is worth consideration, and, as an instance of its application, we believe that for the more diligent supervision of the Abbontiakoon group of mines on the Gold coast, this little machine is employed by the manager, Mr. E. V. Bensusan. The motor vehicle, moreover, is not only a beast of burden. When not on the road, it may be turned to winch, to pump, to drive compressor or fan, to furnish electric light, to saw timber or crush ore. It is a jack of all trades, able and willing to work day and night without fatigue, murmur or complaint, and without a demand of time and a quarter for overtime. We believe that, in the near future, motor transport will be largely used for mining purposes, and will greatly conduce to success. But a word of caution is necessary.

The manufacture is a specialty, and, unless disaster is courted, there is no scope for directors or manager to test their pet theories of construction and design. —*London Mining Journal.*

* *

The Finance Committee of the City Council of Oakland, California, has recommended that a police patrol automobile and ambulance be purchased at a cost not to exceed $3,000. The ambulance is for the purpose of connecting with the Receiving Hospital, says the *Oakland Times*, while heretofore the unfortunates had to take the jolting of the patrol wagons before they received treatment. The Board of Public Works was authorized to advertise for bids.

Information for Buyers

SPEED RECORDER.—The Bullard speed recorder, manufactured by J. H. Bullard, of Springfield, Mass., tells the time, the speed, the distance, and makes a permanent record on a detachable card of every mile travelled, showing graphically when stops were made and how long, thereby offering a valuable means for holding drivers of power wagons down to the maximum or minimum speeds at which they have been told to drive. This instrument consists of a clock, a speed meter and a speed recorder all combined in one casing. It is connected to the wheel of the car by a flexible shaft and no part of the instrument revolves faster than the wagon wheel, thereby assuring the durability and long service of its mechanism. The time and distance can be read from the seat. The case is of heavy brass, dust and water proof, with a thick beveled plate glass over the card. The latter is divided into small spaces by radial lines, and the interval between each pair of radial lines represents one minute. It is also divided by 12 concentric circular lines, and the recording needle in travelling around makes its marks in the minute intervals in the first hour circle first, of course; then moves to the second hour circle and travels around it, and so on, making each card good for 12 hours' running, when a new card may be inserted. The recorder makes a dot for every quarter of a mile the vehicle travels, and for convenience in reading every fourth dot is enlarged, so that the correspondence between full miles and full minutes is easily told at a glance. The instrument is about 4½ inches in diameter and is attached to the dash or any other preferred place by a joint that allows the dial face to be turned at any angle that suits the operator. The details of the mechanism in the instrument are of course subject to variations according to the diameter of the front wheel, to which the gear is to be attached.

LIFE OF TIRES.—A report to his company by Auditor S. E. Morrow, of the Hartford Rubber Works Co., of Hartford, Conn., shows an average mileage of 11,669 miles before scrapping for 14 solid rubber tires bought from the company in 1901 and 1902, since which time further improvements in tire construction have been made. The mileage varies not a little for the different tires, running as follows for each of the 14 tires: 7,333, 10,487, 13,939, 17,581, 15,069, 9,644, 16,499, 14,680, 8,779, 13,242, 12,409, 6,166, 9,882, and 7,660.

BREWERY WAGONS. — The Anheuser-Busch Brewing Company, of St. Louis, Mo., recently placed an order with the Pope Motor Car Co., Waverley Department, of Indianapolis, for 10 Pope Waverley electric 1-ton trucks. The form of the body was specially designed for the brewing company, who have been using electric propelled wagons and trucks for a number of years, and are, in fact, the most extensive users in the world of this class of power wagons, employing them not only in this country, but also in connection with their European depots.

"DIAMOND" CHAINS
Outnumber, Outwear and are Stronger than Others
WRITE FOR CATALOGUE
DIAMOND CHAIN & MFG. COMPANY
INDIANAPOLIS, IND.

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Comparison of Two Machines

A Glance at the Difference in Design and Probable Efficiency of Animate and Inanimate Structures

FOR business purposes, all that counts in a horse are its qualities as a machine employed for performing certain work. When the same work may also be done by means of other machines, there is reason for comparing the performances, to see which is in best accordance with the requirements. Among business men, however, it is customary, before going to the trouble of comparing work results, which are nearly always somewhat complicated, to compare the machines directly, with one another, so as to be able to form an opinion in advance as to which of the machines "ought to be" best adapted for the work to be done.

A printing press, a piano and a phonograph are all admirable machines, each of marvelous ingenuity in its kind, but this would not be considered a good reason for attempting to employ them for pile driving, even if it were possible to use them in that manner; pile driving being a very simple operation, consisting in straightlined motions of a hard and heavy substance, for which it is unnecessary and wasteful to employ fine machinery.

The work of hauling merchandise is not nearly so simple, but still it has been shown to be reducible to a few motions, of shafts, clutches and gearing. Those few motions, in connection with a wagon with wheels, constitute all that is wanted. Anything more than the machine employed for the work does, or is capable of doing, represents a probable waste. On general principles, a business man, upon having shown to him one machine capable of performing just those required motions, rapidly, precisely and continuously, and another machine capable of producing the same effect upon the wagon, less rapidly, less precisely and for only a strictly limited time, but on the other hand capable of doing a great many other things not in the line of the man's wants, would probably select the first machine. To make him do otherwise in this age of specialized machinery, would probably require an extraordinarily convincing demonstration of superior economy in the employment of the more intricate tool with the many superfluous motions and capacity for work not wanted.

Where flesh and blood enter into the composition of one of the machines, the disposition of business men is not so uniformly in favor of the specialized and simplified machine, unless the flesh and blood are human. There is very little hesitation about replacing machine motions involving the employment of a human, by an automatic piece of inanimate machinery, provided the latter performs more work at smaller cost; and this although neither "first cost" or "depreciation" plays any part in the figuring.

Apparently habit and custom have something to do with the matter. The machines saving human labor were introduced a long time ago, and the business mind has had many opportunities for familiarizing itself with the idea of dispensing with it, in so far as possible. The replacement of animal power is still a little new, in the matter of local transportation work. The comparison with other machines which perform the same work has not yet been made, in a direct way, and the comparisons of performances have not been available to all and, besides, being somewhat complicated, have presented disputable points.

It is a direct comparison, then, from the machine point of view, which is most urgently required at present. The horse machine is to be compared with all the more modern specialized machines designed to do its work; that is, for practical purposes, with the electric power wagon, the gasoline motor wagon and the steam vehicle.

For brevity's sake one comparison must do, particularly as it is the old, well-known horse-machine which has been least described, of late. Unlike the chassis of the gasoline vehicle, its mechanism cannot easily be shown in one drawing. The first and largest illustration on page 3 shows essentially the frame (skeleton), the power-generating (alimentary) apparatus and the running-gear

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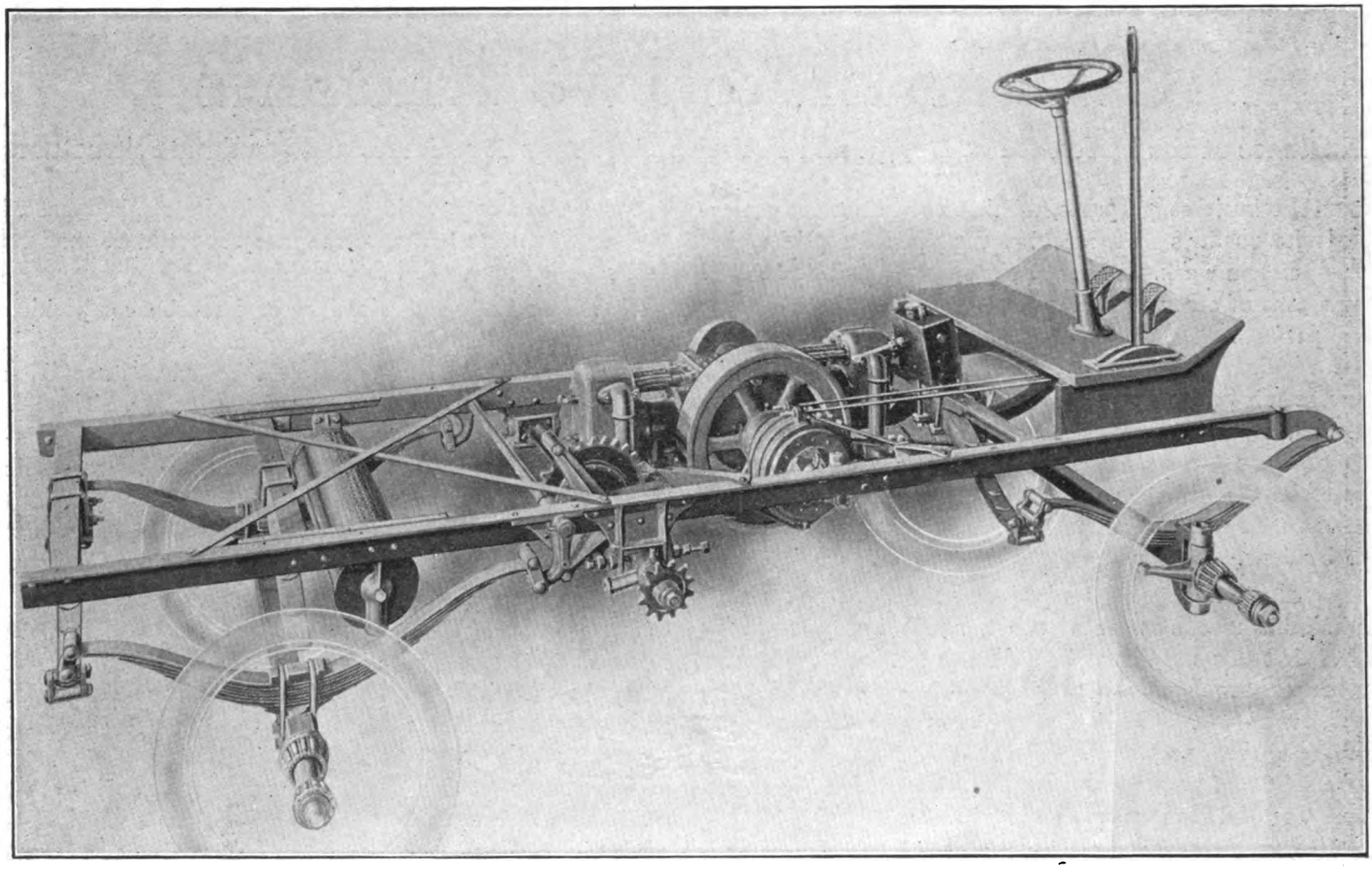
(legs). Number two, on page 4, shows the horse's power-storage system which is combined with the transmission elements, consisting in muscles charged with a mysterious capacity for contraction, by folding of their tissue, which is transmitted through tendons to the various bones forming the principal elements of the legs or running-gear of the machine.

The illustration of the gasoline motor chassis on page 2 was selected mainly with a view to showing all the vital parts of one of the simplest transportation machines known to have produced economical work-results. It represents the chassis of a "Rapid" express or delivery wagon of 2,500 pounds load capacity, capable of doing the work of three to four horses and wagons.

Properly, the comparison should be between the chassis and three or four horses. The complications represented in the pictures of the horse-machine should be mentally multiplied by three or four.



COMPLETE CHASSIS AND POWER PLANT OF SPECIALIZED TRANSPORTATION MACHINE OF GASOLINE MOTOR CLASS

The gasoline motor transportation machine, which takes the place of three or four horses and of all the expensive parts of the three or four wagons drawn by them, consists of (1) a frame of angle iron which lasts indefinitely, if painted; (2) an engine of cast iron in which only certain replaceable portions are subject to wear; (3) a shaft rotated by the engine and assisted by a (4) fly wheel to maintain its rotation equably, without jerks; (5) clutchbands adapted to grip the shaft and transmit the motion to one or another of two sets of toothed wheels, either of which (according to which is clutched to the engine shaft) causes a (6) second shaft with a sprocket pinion to revolve; (7) a chain from the pinion to a (8) larger sprocket mounted upon a (9) balance gear capable of transmitting motion to a (10) divided shaft in such manner that one side of this shaft may revolve faster than the other; (11) sprocket pinions on the ends of the divided shaft; (12) chains from these pinions to (13) sprocket wheels on the (14) vehicle's rear wheels, mounted upon (15) roller bearings upon the ends of a (16) rear axle shackled to the vehicle frame by (17) platform-springs. Another set of platform springs is shackled to the front end of the frame and secured to the (18) front axle, each end of which is forked to hold a short vertical (19) pivot pin from which projects a roller-bearing (20) rock shaft carrying a (21) front wheel. To steer the vehicle's course, the front wheels are turned out of alignment with the rear wheels by turning the pivot pin of each by hand power applied to a (22) steering crown mounted upon the end of a (23) hollow vertical or sloping shaft carrying upon its lower end a (24) screw acting in (25) sleeve with a rack, the latter rotating a (26) shaft communicating the required motions to the two pivot pins and front wheels.

The main features of the engine, or power-generating apparatus, are: (a) two cylinders with water jackets, (b) two pistons with piston rings, (c) two connecting rods with bushed bearings at each end, (d) a tank containing gasoline with pipe connection to (e) a carburetter from which gasoline is drawn in a fine, quickly

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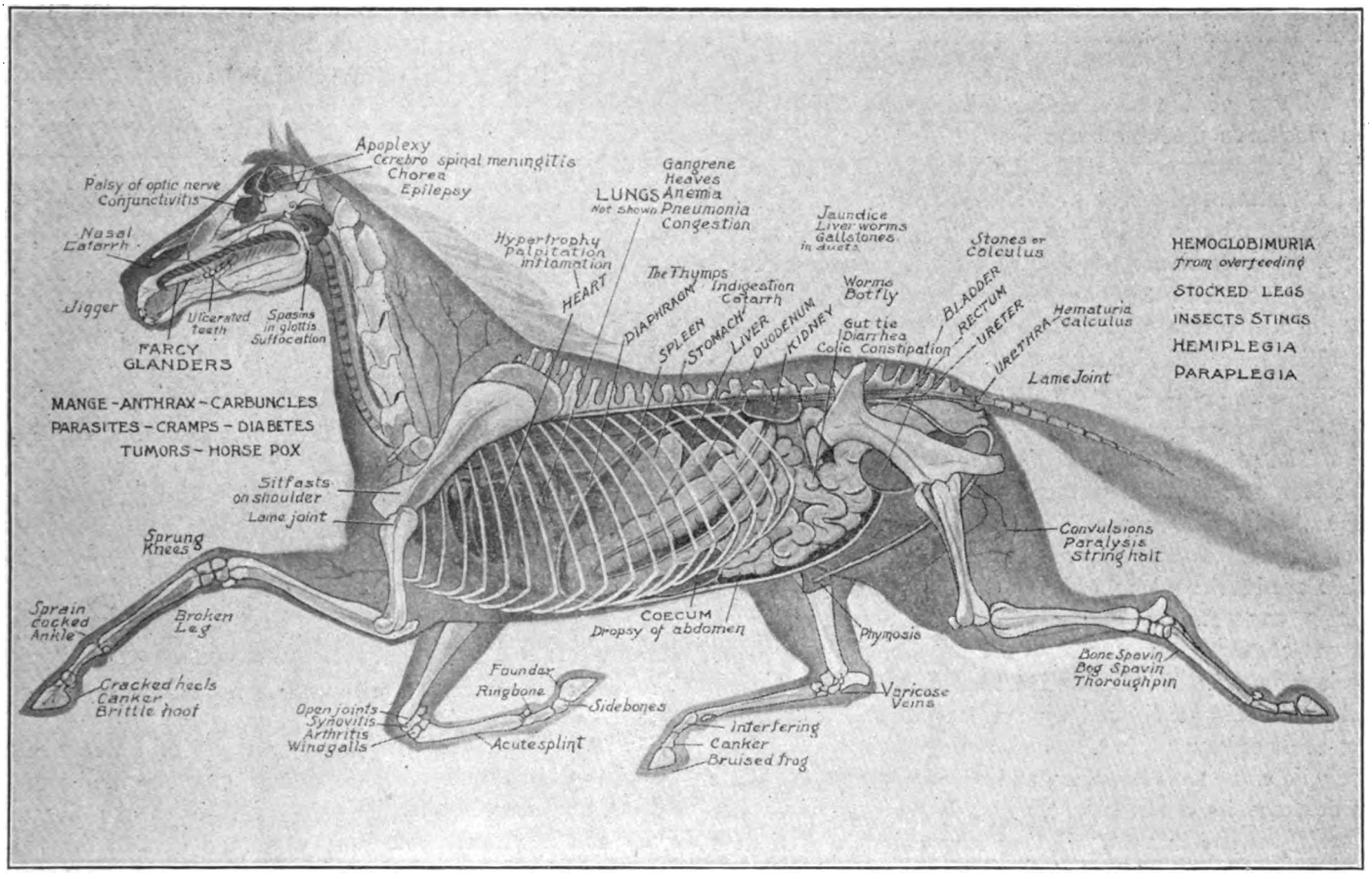
evaporating, spray, by means of suction created by the movements of the pistons, through (f) inlet valves into the cylinders together with a varying proportion of air, forming an inflammable gaseous mixture, which is compressed by the next movement of the pistons, then ignited by electric sparks caused by current from (g) an electric battery or other source of electric current, thereby rapidly expanded, causing the pistons to be thrust back, rotating the engine shaft by means of the connecting rod; engine shaft carries (h) a spur wheel meshing with (j) twice as large spur wheel on (k) a cam shaft, thereby rotating the latter which carries cams acting upon ends of rods which open (l) exhaust valves, permitting burnt gas to escape through (m) exhaust pipe to (n) muffler where its expansion is retarded in order to deaden the sound of its escape. Camshaft also operates (o) water pump serving to send hot water from water jackets surrounding the cylinders into a nest of pipes called (p) a radiator, where it is cooled by exposure, and back to the cylinder jackets, thus keeping cylinders comparatively cool.

Adding hereto (q) a tank of oil with (r) pump operated from the cam shaft, injecting a measured quantity into the cylinders and at various bearings at regular intervals, a few (s) rods and bell cranks operating (t) throttle, clutches and (27) brakes by means of pedals and lever—and an essentially complete description has been given of the whole well-known combination of simple mechanical elements, every one replaceable and repairable, which constitutes a gasoline motor transportation machine, and which has here been enumerated without strict reference to possible minor deviations in the particular machine shown in the illustration. It is protected by the springs and by rubber tires against jars and severe shocks.

An electric transportation machine is even more direct and simple, and all that weighs against it, in a comparison with other specialized machines, consists in the similarity which exists between the functions of a storage battery and those of an animal. Its condition is not subject to simple and positive mechanical regulation and it is not capable of supplying power continuously.

The business man is now confronted with four other machines, essentially alike in health but varying greatly, unaccountably and irremediably in disease. Each is a



FRAME AND CHEMICAL ENGINE OF HORSE—WITH INDICATION OF LOCAL AND GENERAL DISEASES

horse and the four of them, combined with wagons, are claimed to be able to perform as many ton-miles of transportation work in a given time and at a certain cost, as the one machine described above.

It is admitted, however, from the start that these machines must have periods of rest and that the comparison between the working capacity of the four of them, plus wagons, and the one gasoline motor machine, is based on similar periods of rest for the latter, though it does not require them, but may be worked all the time, thereby replacing six to eight horses and three to four wagons.

It is also admitted, that the horse-machines were designed in years of remote antiquity by an unknown

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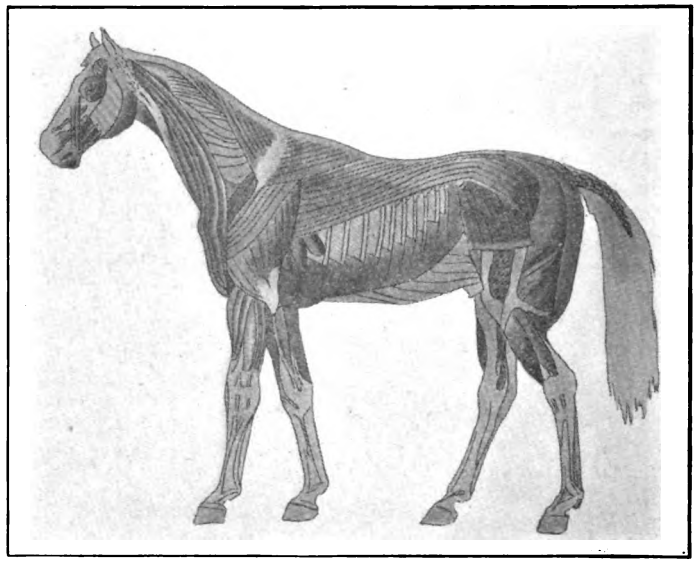
master and not for the work of transporting merchandise; that, when they get out of order, the owner must wait till they are restored to usefulness by automatic processes not subject to control, as nobody understands their mechanism well enough to take it apart and put it together again—not even the smallest part of it. The machines require attendance and fuel supply all the time, whether worked or not, but compensate for this by a very large measure of automatic regulation, so unfortunately constituted, however, that the more the machine is worked the poorer is the regulation. This is probably because it never was the designer's intention to have the mechanism subject to constant wear and tear, but merely to propel its own bulk. Work results in many abnormal conditions of the machine and its organs, while these usually remain in perfect order when the machine is running idle in a paddock, with a small fuel supply and some protection against severe weather.

Some of the abnormal conditions interfering with the machine's usefulness are known by name and recognized by symptoms. Unlike the wear of a valve or the bad adjustment of a carburetter, they are not strictly local, however, and cannot be remedied locally. In the accompanying illustration a number of disorders are marked as belonging specially to one or another of the machine parts, but in reality the whole organism is so ingeniously cooperating in all its functions that no one part may be independently restored to working order when once deranged.

The principal features of the machine are as follows: The frame or skeleton is composed of 200 to 300 jointed bones held together partly by atmospheric pressure and partly by a covering of muscles and tendons. All the joints are lubricated by a highly complicated and thorough system, apparently operated on the plan that fresh lubricant is conveyed to a sac surrounding each joint by diosmosis from adjacent diminutive tubes containing a liquid, and the lubricant vitiated by use is returned by another system of capillary tubes. The details of this system form a complete mystery, however, and when stiff or open joints result from its derangement, there is nothing to do but to wait, usually in vain. Spring suspension is carried to an extraordinary and admirable extreme in the horse-machine. Starting from the points of contact with the ground, there is a cushion of cartilaginous tissue protecting the bone pipes of each leg from injurious vibrations. Each bone is essentially rigid, but each joint affords elastic support on the plan of a V-spring, and as the joints are very numerous, scarcely a tremor should reach the more delicate organs from the impact of the hoofs with the ground. In this respect the horse-machine affords a model for study by makers of the simpler, inanimate transportation machines, and puts to the blush those who think that the ordinary rubber tire is a superfluous precaution for the protection of their mechanism.

The cooling system of the horse is also of the most elaborate character. When overheating is threatened, there is by some unknown process abstracted a saline and acidulated liquid—probably non-freezing—from either the blood or the gastric juices (which are continually supplementing and drawing upon one another) and this is by another unknown method sent through a system of tubes ending in a fine capillary network of pores piercing the outer covering of the machine, and the liquid is deposited on the outside of the covering, where it evaporates, thereby radiating heat very effectively. Under ordinary working conditions this highly efficient system seems subject to clogging and disorders, however. In fact, the very extensive employment of hair-fine tubes in the whole machine is to be considered as a dangerous over-refinement, resulting in the disorders known as catarrh, congestion, inflammation and probably the majority of diseases affecting the bones, such as spavin and founder, whenever the maintenance conditions depart from the ideal in the least.

The power-generating apparatus is of the chemical



POWER STORAGE CELLS AND TRANSMISSION MECHANISM OF HORSE

type. Vegetable fuel is disintegrated by acid treatment; certain portions of it are subsequently expelled while others are absorbed by transfusion through the fibrous walls of the vessels containing them and carried through capillary tubes into the blood and are thence carried further to storage cells, known as muscles, and temporarily deposited in a manner that produces power, by means wholly unknown, when excited by a current sent automatically from brain or spine. A vast number of intricate machine parts are engaged in these processes and in many additional ones, mostly of totally unknown character.

To attempt a complete description of them would be hopeless, partly for lack of space and time, but mostly because the whole construction and manner of operation of the machine is shrouded in mystery. So long as the business man had no other choice, he utilized this machine to the best of his ability.

But now—would he naturally select it for doing his work, after a casual comparison with other machines specially designed for that work?

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Principles and Practice In Transportation by Motor Vehicles

An Outline of What Has Been Learned by Experience with Power Wagons in America

I—The "Best" Power Wagon——II—First Cost of Equipment——III—Saving in Human Labor——IV—The Life and Durability——V—Together With Horses——VI—Training of Drivers and Others——VII—A Factor in Business Control——VIII—Tires and Other Buffers——IX—Assortment of Vehicle Sizes——X—Load Capacity Ratings——XI—High Pressure Installations——XII—Garages, Public and Private——XIII—Trucking and Express Companies——XIV—Municipal Uses and Service Stations——XV—Public Service Work——XVI—The Agricultural Interest——XVII—Speed Checks—Control Instruments——XVIII—Traction Devices—Winter Wheels——XIX—Apprentices in Shops and Stables——XX—Accounts and Their Keeping——XXI—Steam Vehicles, Now and Later——XXII—The Sociological Side.

By finishing in this issue the serial article "Principles and Practice in Transportation by Motor Vehicles" and reproducing at the same time all those sections thereof which have appeared in previous issues, *The Power Wagon* complies with the requests of readers who did not receive the first instalments and desired to be in possession of the whole series in convenient form.

Reading the series with pencil in hand, and marking passages which he felt applied directly to his own case, one appreciative correspondent found that he had learned to view the economy of his transportation system collectively, with the various factors brought in relation to each other, while previously he had overlooked some of these factors—even important ones—and had viewed most of them singly without giving much thought to their interdependence. He did not approve everything to the last iota, but he thought he would be money ahead in the future for having taken the time to read and criticise.

As this view coincides very well with the purpose of the article, it is herewith recommended to other readers, with emphasis on "pencil in hand."

The fundamental object of the series was from the beginning to facilitate thought and decision on the highly complicated subject, by arranging the material for thought in an orderly manner. This, it was believed, would render it possible for a business man to judge what he should take into consideration before acting or not acting. His own knowledge of his own business is the link which *he* must supply. Practical details, helpful toward making all conclusions definite, are what *The Power Wagon* must supply from week to week, in addition, as fast as they may be gathered in presentable form.

I

The "Best" Power Wagon

PRECONCEIVED ideas in regard to the economical superiority of one type or another, among power wagons, melt as snow under an April sun, when put to the test of experience.

The gasoline vehicle is the best! The electric vehicle is more suitable! The steam vehicle is the only one that will do the work! The gasoline vehicle with electric transmission equipment presents the true combination of most desirable advantages! The horse-and-wagon system beats them all!

According to the nature of the work to be done, each of these assertions may hold good or prove wholly false.

Promulgated in all generality, all of them are false.

If human labor were not an important factor in all transportation systems, it might be possible to generalize. With human labor to count with, and the human short-comings in grappling with new, though simple, problems, it is not generalizing but generalship that is required.

Generalship in the very selection of one's battalions!

Whatever perplexity may arise when generalship is demanded of one inexperienced, resolves itself into something less fatal to decision, however, when it is accepted as a truth that power wagons of any type will do any work more cheaply than it can be done by horses and wagons, *if* they can do it at all, *if* they can do it practically all the year round, and *if* they are properly treated.

The first "if" may be eliminated by test; the second through knowledge of climate and roads; the third has nothing to do with the first choice of the type, except in so far as local conditions may render it easier to obtain competent help and quick repairs for the operation of one type than for the operation of another.

Essentially, the two resources: Test and Opportunity will guess the conundrum of the first choice of type. The system which, under actual workday test, rises most readily superior to the demands of the work, is naturally to be preferred, but the Opportunity for obtaining wagons without delay, well-built, from a responsible and accommodating manufacturer, of the right sizes and styles, necessarily enters for almost equal consideration in making a choice.

At the present moment, for example, the opportunity for selecting steam wagons is, in this country, at a low ebb, because very few are produced.

Gasoline and electric vehicles divide the field for transportation over the ordinary roads and streets, while the combination system—gasoline engine as power source with electric drive—bids strongly for all rail service.

Compressed air and carbonic acid gas machines have fallen by the wayside, for the present at least, largely because they operated as traveling ice factories and were not exempt from dangers of explosion.

Practically, the choice lies between gasoline and electric vehicles, with steam wagons a possibility worthy of subsequent investigation.

The decision to which generalship must be applied is not quite so narrow, however, as a choice between two. It includes the determination of the extent to which the horse-and-wagon service should be replaced and some preliminary assurance of

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being able to organize, or dispose over, a plant for the maintenance of whichever type of power wagon is adopted.

Most business men will be inclined to let the power wagon earn its spurs and promotion in those branches of his work, first, for which horses are least suitable. Concession to *status quo* and avoidance of abrupt changes are among the axioms most generally adhered to in the business world, even at a sacrifice of what seems a certain prospective addition to economy and profits.

In choosing the type of power wagon to be added to his transportation plant the owner of the latter will therefore, in many cases, be at liberty to apply his test to highly specialized forms of his work and to make his selection in favor of gasoline wagons, though under different circumstances it should have been in favor of electric wagons.

The electric system thrives best, economically and otherwise, when it does *all* the work, in exclusive installations where the labor of maintenance may be organized with an extreme of method, order and precision. The gasoline wagon seems to tolerate the proximity of the horse more willingly, if only each individual power wagon has a capable attendant, but the difference between the types in this respect is probably more fancied than real, or at all events not of permanent validity. In large establishments, such as, for example, that of Keyes, Marshall & Bros., of St. Louis, where horse, electric and gasoline wagons are maintained in large numbers under one ownership, it has been found imperative to separate the plant into two installations, one comprising the power wagons and the other the horse-and-wagon equipment.

Probably no dogma on this subject will hold true under all circumstances. The owner of a small plant, who has personally familiarized himself with the best rules for treatment and maintenance of the power systems, and who is close to his help in a spiritual sense, frequently obtains excellent results from a first choice of vehicle, which under strictly corporate management would have been injudicious, and from a maintenance system in which an outsider would fail to discover any system at all.

Some users of power wagons have found that the first test of their capacity for doing the work of the horse should have been supplemented by a test of what the wagons would do after one year of service. Frequent repairs of the machinery of gasoline wagons and battery deterioration, resulting in reduced traveling radius, in electric vehicles, were the points mostly at issue.

This brings to the surface the last "if" in the question of the economy of power wagons; that relating to *proper treatment*, after the selection of the type or types has been made.

Whether the choice has fallen on one type or on the other, or on both, and whether the installation is to be auxiliary to the horse-and-wagon system, in one proportion or in another, or is to do all the transportation work on hand all the year round, the experience of the past few years declares unequivocally that *proper treatment* is the principal and indispensable source of economy of power wagons, just as it is in the case of transportation work by horses, but differing in being subject to exact knowledge and systematic supervision, while affording at the same time a much wider margin for accomplishing unusual results, in the efficiency of the work as well as in its economy, according to the degree of attention and energy given to the subject.

The "best" power wagon, year after year, is the one which is best treated, treated most nearly in accordance with its nature; other considerations being insignificant in comparison.

"Proper treatment," in all its variations and details, naturally, therefore, also becomes the chief subject for any publication aiming to be of practical usefulness for owners of power wagons.

II

First Cost of Equipment

OUTSIDE of those circles in the world of large business and finance where the earning capacity of the power wagon has been looked into from all points of view, it is commonly taken for granted that "whatever else may be the merits of commercial motor vehicles, their first cost is certainly very high," or it is said: "American business men like to get along with a small first investment and to increase it gradually out of their profits, and for this reason they can't be expected to take kindly to motor trucks which cost $2,000 to $5,000 apiece."

Without entering upon any discourse relating to the financial habits or necessities of business men in this country of high business profits—habits and necessities which are undergoing constant and somewhat radical changes, by the way—the offhand views presented in the foregoing typical remarks on the high first cost of power wagons are readily shown to be off the mark.

To simplify the matter, all consideration of the earning capacity of the power wagons may be omitted, though from the financier's standpoint it would justify high first cost.

The question is, then, one of first cost without regard to justification; first cost, pure and simple, omitting even the important factor of depreciation, which, under proper conditions of maintenance, is strongly in favor of the power wagon system.

What does it cost to install the power system?

And in comparison, what does it cost to install a horse-and-wagon system of the same working capacity?

A bit of industrial history which throws light on these questions became detached from the archives of one of the large express companies about two years ago. It floated for a while from one to another of those most deeply concerned in such matters, in the form of a document studded with all the facts and figures, and was then withdrawn from public gaze and carefully locked in the strong coffers of the concern for whose information and use it had been made. Nobody had copied it, but the total figures had escaped and are known this day. The document gave a careful estimate of what it would cost the express company to install its service in Buffalo in a certain location; what it would cost for a horse-and-wagon service and what it would cost for electric service. Counting real estate, buildings and their necessary equipment in each case, the comparison stood $80,000 for the horse-and-wagon service, and $20,000 for the electric service. Neither the horses-and-wagons nor electric vehicles were included. There was $60,000 plus the cost of horses-and-wagons "to the good," wherewith to buy electric vehicles. As subsequent developments proved, the company established an exclusive electric service, and, about one-half year ago, had 17 electric vehicles in operation, representing a cost of perhaps $35,000. They also had considerable room in the new garage for expansion.

That the figures must vary greatly with the cost of real estate and of building operations, as well as with the nature of the service to be established, is self-evident. They may be more favorable or less favorable for a gasoline vehicle or a mixed installation, but probably the difference would be slight, one way or the other.

Nothing short of a considerable number of worked-out estimates from cities of greatly varying size and based upon varying fast service, slow service, long hauls, short hauls, etc.,—would requirements of work—heavy and light trucking, delivery work, supply comparisons of directly applicable utility.

Some imaginary figures will make the matter clear, however, in a general way. Assume a light trucking service with either gasoline or electric vehicles at $2,000 apiece. In this class of work one power wagon replaces from 2 to 3 one-horse trucks. An installation of 20 power wagons would therefore equal 50 ordinary wagons and 75 horses, a 50 per cent reserve of horses being required for equal reliability.

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Each power wagon occupies about 60 square feet of area in the garage, and 50 per cent more space is required for manipulation and cleaning, repairs or battery charging. On the two or three-story plan, the ground area may be further economized.

The area of the power wagon plant is now seen to be 20 times 90 sq. ft., or 1,800 sq. ft.

The fifty wagons, on the other hand, occupy about 50 square feet each and the 75 horses also 50 square feet each, while the allowance for stable work must be at least 100 per cent, making the total area 125 x 50 sq. ft. x 2, or 12,500 sq. ft.

If arrangements are made for housing 20 drivers and 3 stable men in the power wagon building and 50 drivers and 10 stable men in the other building, the disproportion in ground areas or in cost of buildings is further increased.

But suppose the cost of the buildings is proportionate to the areas of 1,800 sq. ft. in one case and 12,500 sq. ft. in the other, and that fixed equipments are in the same proportion. Then, if the cost of the power wagon garage is $3,500, that of the horse-and-wagon building will be $24,306. Counting harness, blankets, etc., as belonging to maintenance and not to first cost, this leaves the comparison, at $160 for each horse and also $160 for each wagon, and at $100 per square foot of real estate, as follows:

POWER WAGON INSTALLATION		HORSE-AND-WAGON INSTALLATION	
Real Estate	$ 1,800	Real Estate	$12,500
Building	3,500	Building	24,306
Vehicles	40,000	Horses	12,000
		Wagons	8,000
First Cost	$45,300	First Cost	$56,806

On a smaller scale the owner of the garage will lose some of the financial advantages of compactness, but, on the other hand, he will often be enabled to place his garage in immediate proximity to his place of business, possibly on an unoccupied part of the ground he previously owns, while a horse-and-wagon establishment must almost necessarily be in a different locality, where the master's eye cannot rest upon it as often or as closely as his interests would require.

Apart from special conditions, however, calculations relating to first cost suggest undeniably that business men contemplating the use of power wagons on a moderate scale might do worse than combine in stock companies for the erection of garages and for the subsequent work involved in proper, economical maintenance.

III

Saving of Human Labor

SAVING of wages by the use of power wagons is beyond all doubt the principal source of their economy.

On a grocery delivery circuit the power delivery wagon covers from 40 to 60 miles in the delivery hours of one day, while the single horse covers 15. The grocer who has use for 60 miles of route work saves the wages of 3 drivers, or from $1,000 to $1,800 per year.

The heavy horse-truck makes an average speed of little over 2 miles per hour. With time consumed in loading, unloading and waiting, 8 to 10 miles is the average daily performance. The radius of action is practically limited to 6 miles from the place of business. Starting in the afternoon a 4 mile trip means overtime and complaints. Many odd hours are completely lost to usefulness. The power truck fits better in the hours of the workday. It makes 4 to 7 miles per hour, even with loads from 3 to 5 tons, and whether the weather is hot or cold. It can go 6 miles from home 3 times per day, or it can go 20 miles from home if necessary and return without extra charges for overtime or relays or nights' lodging for the driver.

Except for such work as very short and numerous exceedingly heavy hauls—as from a city place of business to nearby docks with loads of 7 or 8 tons—the heavy power truck replaces 2 to 3 horse-trucks of equal load capacity. The saving in wages of 1 to 2 drivers, drawing $10 to $12 weekly in minor cities and up to $18 in the larger cities, will average about $1,200 annually.

While the life of horses engaged in very heavy slow hauling is almost double of what it is in lighter and faster trucking work, their first cost is much higher, and the power truck replacing an average of 6 of these costly heavy-draft animals and 2 to 3 of the heavy trucks, makes room in the stables, as well as at the loading platform, for additional vehicles, for which there is often urgent demand in a growing business cramped for space.

After all, the greatest saving of human labor is accomplished, however, in businesses which have heretofore required two-horse trucks of 1½ to 3 tons load capacity going at a speed of 4 to 6 miles per hour, going and coming, mostly with empty returns. Once outside the most congested traffic, the light power truck of similar capacity doubles this speed with no greater wear and tear than may be offset at low cost by a strict system of daily inspection and maintenance, while on the other hand, the mortality among horses in this class of work is immense, and seemingly unavoidable, and the necessity for reserve animals exceeds even the requirements for light merchandise one-horse delivery wagon work.

Double speed by power wagons in the two-horse light trucking field means triple working capacity and triple replacement of drivers. There are no very definite data available to substantiate this assertion and the truth of it is indeed modified by the length of hauls, the duration of stops and several minor factors. The extra gain, beyond that which would be expected from the proportions between speeds, seems to come in through a much improved utilization of the working hours; hours and half-hours which go to waste with the lower speed may be, and are utilized with the higher. Work at the loading platforms is distributed throughout the day, getting more efficiency from the shipping department or the same efficiency from a smaller number of men; the arrangement of routes is facilitated by the certainty that the power wagon will return for another load on the same day; stops are shortened by the ease of making detours if the load has been placed without correct reference to the succession of deliveries.

In special work such as delivering and hoisting safes, the power wagon with a winch operated from the power plant, saves the labor of 4 men. In winding and unwinding wire and cables for electric light companies or telephone companies in the large cities, the same arrangement saves up to 12 men, and by dispatch in reaching the spot where such work is required, the power wagon saves "waiting time," for a large crew, if there is no power winch; and for a small crew if the wagon incorporates that feature.

The winch is only the first and most obvious application of the principle that the power wagon may replace human labor in other forms than by simple transportation. In timber operations the portable saw, in mining operations the portable pump, in agriculture all the various forms of portable work, are instances to the point, as yet awaiting further development.

In all cases when the nature of the work requires an attendant for deliveries or a solicitor of trade to go with each wagon—in addition to the driver—the wages of each attendant are, of course, saved in the same proportion as are those of the drivers, and in such instances the figures of the saving, as referred above, may be practically doubled.

The economies so far mentioned, it will be noticed, are independent of the size of the installation, except in so far as the volume of business to be done should as nearly as possible exhaust the working capacity of the power wagon or wagons. Stable charges, on the other hand, while immensely economized in the large systematically organized installation, whether electric or gasoline or both, depend in the smaller plant upon questions of

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personnel and of local facilities for quick repairs and replacements, which admit of no general discussion. That a reduction of stable charges is possible, however, even in the smallest plant, is the contention of many who have tried out the question with a single power delivery wagon. The feature in the economy which helped them out was usually this: That, while the owner would not consent to take care of horses and wagons personally or with the aid of his clerks, but placed them in a livery stable, he was willing and anxious to house and groom the power delivery wagon on his own premises.

IV
The Life and Durability

IN business and mechanics long life is a virtue only if crowded with activity, money-earning activity. The life of costly tools is sacrificed in every machine shop to stimulate production. But no tool wears so irretrievably as the animal, because it cannot be repaired.

The vitality of a $150 horse drawing 1 ton 15 miles per day is spent in 600 to 900 working days, giving a total of 9,000 to 13,500 ton-miles, by which to justify an investment of $150 and the feed and other maintenance expenses.

Two heavy dray horses at $400 apiece draw 6 tons 10 miles for 2,400 days, giving a credit of 72,000 ton-miles for each animal; that is, for justifying an investment of $400 plus feed and other maintenance cost.

Figuring the expense of keeping the $150 horse at $30 monthly and the $400 horse at $40 monthly, the two investments, with current expenses added, are, roughly, $150 plus $30 x 36, or $1,130 for producing 13,500 ton-miles of transportation work, and $400 plus $40 x 96, or $4,240 for producing 72,000 ton-miles.

Which pays better? Where the figures, as given, apply, there are 21,345 ton-miles "to the good" for the slow, heavy-draft animal of the long life, even counting driver's wages as balancing evenly.

Where different maintenance figures would apply, the result might be materially changed, but as a rule it is found that a small increase in the average speed of a working horse must be paid for in a considerable reduction of loads and in a great, but less economically important, reduction of its life-time.

Where still higher speeds are required of horses, as in stage and omnibus service, the number of animals required for shifts and relays, waxes rapidly to an economically forbidding height, so that in London omnibus service, for example, the introduction of one power omnibus takes up to 22 horses out of action.

Evidently, a direct comparison between horse-and-wagon service and power wagon service on the question of life, is of little value, because the life of the horse (and of the wagon, too) is deliberately sacrificed for business considerations that cannot be expressed by a ton-mile measurement, and because the life of a power wagon—contrary to that of a horse—is no direct function of loads and speed, but depends mainly upon the maintenance system.

Given a reasonably suitable construction to begin with, the life of a power wagon may be almost indefinitely extended by replacement of its wearable components, and such replacement may, in turn, be immensely economized by intelligence and watchfulness.

The horse is mystery and misery. The power wagon all system.

Crowd 50,000 miles of heavy travel into 2 years of one power wagon's service, and it would seem unfair to expect as long life of such a vehicle as of another vehicle going only half this distance with the same load in the same time. Yet, it is mainly a question of skill and money to make the first wagon emerge from its harder service in as good, or better, condition as falls to the lot of the other wagon under a maintenance system either less skilled or less liberal.

The Brooklyn Bridge would have fallen down long ago, but for the repairs.

Trolley cars run for 4 months to 6 months when new without repairs. Thereafter they are repaired every few days.

Locomotives are repaired, or gone over, for every 110 miles of work.

The gasoline engine has some wear of valves, rods, cams, and all other replaceable details. Piston rings give out. But with perfect lubrication the main portions of the engine last indefinitely. A good maintenance system looks out for the lubrication.

In the electric wagon, batteries are "slow fuel," comparable to horse feed and gasoline. They last no longer than a corresponding quantity of oats, hay and straw. The batteries have nothing to do with the life of the wagon, and properly should not be considered under "first cost," either; no more than the advance purchase of a feed supply should be so considered in a horse-and-wagon service. Armature bearings, gears or chains, brake bands wear out, but when repaired, enter again in the constitution of a vehicle which gives perfect service.

The life of a power wagon is indefinite. The body will last according to the service it gives, as other wagon bodies do, and this applies also to wheels and partly to tires, but the chassis and power plant may be kept in running order for a generation.

This is not saying that such has been the method so far usually followed in power wagon installations. The nearest approach is perhaps found in the pleasure vehicle field, in the case of the numerous steam runabouts built in 1898 and 1899 which are now kept in active commission in remote villages by owners personally versed in the machinist's craft.

V
Together with Horses

AS an instrument for producing profits the power wagon *should* reach its very highest possibilities in the mixed installation where it is kept busy in only such work as cannot be done successfully or economically by other means.

Human nature, however, interferes seriously with the realization of this theory. The machine is set to doing "stunts," while its capacity for regular work during *all* the business hours is neglected. Irregularity in one direction breeds irregularity in another. Inspection and maintenance work become haphazard, and it is then only a question of time how soon the machine will give out during one of the "stunts," one or more of the neglected details asserting their rights to stop the whole performance.

No system of book-keeping accords exceptional money value to the exceptionally hard service of long and rapid hauls at fitful intervals, but it does record, faithfully, the intervals of inactivity (by the absence of entries denoting work) and the possible breakdowns owing to neglect in caretaking. And, as nothing counts for so much in making profits as regularity, the book-showing for the machine at the end of the year is apt to be poor.

Where one or two power wagons are used among a hundred horses-and-wagons, the quality of the mechanical supervision which they will receive is also likely to be perfunctory. In some department stores it is entrusted to the chief engineer of the building, who may be a very good engineer, but is naturally an amateur in the power wagon business, and has little leisure for learning except at the expense of his employer. Often it is con-

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fided to the nearest pleasure vehicle garage, whose manager has other things to think of than how best to make money for a truck owner. Again, in the case of gasoline vehicles, it is left to the sole care of its driver, who on general principles would not hold that job if he were competent for more than mere driving. One who can foretell coming troubles from the sound of the machinery or by observation of reduced capacity of a battery, is a rarity except in establishments in which he is held down to responsibility in such matters by a system that enlists his self-interest.

For the reasons indicated, mixed installations have come to be looked upon with suspicion by power wagon experts. They should produce superior results (superior in proportion to the size of the investment in power wagons), but, as a rule, they don't. They make, on the whole, a less favorable showing of economy than even the smallest exclusive power wagon installation, composed of no more vehicles than those which form the power wagon element in the large transportation plant.

As mixed installations, in the nature of things, must continue for some time to be more numerous than exclusive ones, their comparative shortcomings demand an investigation.

The owner, though persuaded to buy the power wagons, may not be steadfast in his faith in their economy. If he were, he would perhaps have seen his way to buy more than one or two or three. But lack of faith is immediately detected and copied by employes, if the latter have no superior knowledge of the subject; and it is fatal. It shifts at once all blame and responsibility to the hapless manufacturer, and even the unanswerable argument that the same kind of vehicle gives excellent results in similar service elsewhere falls upon unwilling ears.

Apart, however, from the owner's attitude, which is bound to yield to sound reasoning, sooner or later, there is one difficulty in the utilization of power wagons by a concern also using horses, which does not seem to have been fully recognized. It lies in the unity of the shipping department contrasted with the duality of the transportation plant. The chief shipping clerk is more or less in touch with the horse-and-wagon service. He *must* know how to organize the horse-and-wagon routes and get the best out of the force at his command, every day. With stable care he may have as little to do as the teamsters, but he reasons in the terms and quantities of horse-possibilities. It is his language.

Now, he is suddenly required to reason and give orders in another strange language at the same time. It does not flow readily from his brain or from his lips. But there is no one else upon whom the routing for the power wagon can be delegated. His work cannot be divided. Unless he is gifted with rare versatility, he will slip insensibly into what is to him the easiest and quickest way of despatching the work on hand, namely, allotting rapidly to the teamsters all he knows they can do, getting them to work and out of the way, and giving *the rest* to the power wagon—all the irregular and emergency work which does not total up and does not cut out right with business hours. Or else, he will go on thinking in the horse fashion, and give horse routes to power wagons, frittering away their capacity for distances and labor-saving.

What is required is that he should reverse this process, giving the power wagons all they can do, including the emergency work, and saving the horses as much as possible. Only in this manner can it be ascertained how many horses can be spared, and that, of course, was the owner's object in approving the partial power wagon installation.

In concerns selling transportation and deriving all their profits from it, such as trucking, cartage, express and livery companies, it has usually been appreciated that the mixed installation must be handled on the basis of making the horses auxiliary to the power wagons; and not the power wagons auxiliary to the horses in any other sense than by giving them, in addition to routine work, the work which horses cannot do satisfactorily.

It seems that the same principle should be extended to partial installations for department stores, manufacturers and wholesale or retail merchants distributing their own goods. But this is seldom accepted in practice by the merchant class.

The difficulty lies in the revolution that must be effected in the shipping department by imparting to its executives, all at once, a new mode of thought and estimate, without divorcing them from their older forms of arriving at quick decisive action.

Mechanical supervision presents a few problems to be solved by each owner, to assure the regular appearance each and every work-day morning of every power wagon in his employ, ready to begin and in condition to finish a hard day's work. But these problems may be solved separately and independently from anything else carried on in the concern. They involve no revolution of thought or habits and do not run contrary to any fixed traits of human nature.

When, nevertheless, the mechanical maintenance of the motor vehicles in mixed plants has often left much to be desired, it may be principally ascribed to the owner's natural reluctance against organizing this end of the work so thoroughly for one or a few power wagons as he would for a larger number. Oftener it is not organized at all, but left to the mercy of the drivers and outside repairmen. Signs are multiplying of late, however, showing a desire among owners for reaping the economies which may be effected by co-operation with other owners in the same locality, through the organization of special commercial power wagon garages, under the management of a competent person responsible directly to them. The desire has not yet been materialized, but the agitation of the subject is not uncommon, and fruitful results seem to await only a keener realization of the necessity of the step, which is only a realization of the self-evident fact that one, two, or three power wagons require mechanical attention of the same *quality* as that which is freely conceded to be necessary for the highest economy in an installation of twenty or thirty power wagons.

Among the means for facilitating an improved *utilization* of power wagons by shipping departments also utilizing a horse service, none is simpler than the imperative demand by the owner for a daily report accounting for the work assigned to the power wagons and the work done by them, coupled with insistence upon having their capacity fully engaged every day.

With regard to *maintenance,* a liberal toleration of small repairs toward the end of the first year of use, will do much to forestall larger repair bills during the second year, if ordinary caution against imposition is observed. In order to guard against interruptions of service, it may be, and usually is, necessary, if electric vehicles are used, to install a charging-plant or at least a charging-board (the price of current being less important than the uninterrupted service of the vehicle), and to keep on hand and in alternate use two batteries for each wagon, some reserve cells, spare pinions for armature shafts, spare gears or chains, spare tires; for gasoline vehicles a full set of valves, cams, crank shaft bushings, ignition spares, clutch leather (if leather is used), transmission gear pinions (crowns of those most exposed to wear), chains and spare tires or spare wheels. Brake bands and clutch bands, where such are used for operating epicyclic transmission gears, may also, as a rule, be required in duplicate. As these parts will all eventually be wanted, to have them on hand in advance is a matter of simple business preparedness in which every manufacturer will be glad to meet the owner's wishes.

Day and night access to machine shop repair facilities is perhaps to be counted among the advantages which the user of power wagons on a small scale may find it difficult to arrange at present.

As soon as the owner of a mixed installation, in the natural course of events, begins to contemplate expansion of its power wagon contingent, the question of uniformity in equipment will present itself to him. As an example in point it may be mentioned that the New York Edison Company's first step after gaining experience with an installation of about thirty electric vehicles of somewhat varying construction details (an installation which has since then been more than doubled) consisted in standardizing all controllers, control levers, steering gears and brakes, partly for the purpose of rendering repair and spare parts interchangeable and partly so that drivers might be changed from one

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wagon to another without experiencing any difficulty whatever in the management of the vehicles in the streets.

Equal, or probably even more cogent reasons for uniformity must apply to an installation of gasoline vehicles, since the perfect familiarity of drivers with the latter is of no small consequence for operating them with business success.

VI

Training of Drivers and Others

OWNERS train themselves by the selection of their sources of information. The keenest experts should soon be found in their ranks. The keenest of them possess a matured knowledge of mechanics and engineering, enabling them to learn quickly and appreciate accurately what constitutes essentials in power wagon construction, use and maintenance. All of them have self-interest as a stimulus to investigation and effort, and self-interest also eventually assists them to escape the error that any degree of general engineering knowledge or scientific acumen can take the place of special power wagon study and practical power wagon experience.

Owners, manufacturers and professional experts will learn rapidly, because they learn mostly at their own expense.

But what about drivers? Must they learn at owners' expense? And if they must, how shall this expense be reduced to a minimum?

Of late, drivers of electric vehicles have commanded only the ordinary teamsters' wages, while drivers of gasoline wagons have obtained half as much again, as a rule. As this proportion in wages has operated greatly in favor of the electric transportation system, in a competitive sense, manufacturers of gasoline vehicles have during the past year taken great pains to simplify operative motions, and to guard against unnecessary interference with the engine and transmission on the part of the drivers. They have aimed to produce a "fool-proof" vehicle, not to be stalled either by crass ignorance or by the violence of an unbridled temper—all with a view to rendering it practicable to train the drivers of horses to drive gasoline vehicles, thereby eventually reducing wages to the ordinary level. At the same time, the axiom has been declared, that driving and caretaking should be two separate forms of work in the case of gasoline vehicles, as much as they are in establishments operating electric vehicles or horses and wagons.

Efforts along these lines will bear fruit, no doubt, and will even react upon the construction of pleasure automobiles and upon the wages paid for driving the latter, but the experience gained in several small installations, while nowise belittling the general importance of those efforts, points hopefully and thankfully to good results accomplished without taking quite so cynical a view of the average teamster's adaptability to a change in work methods.

Evidence tending in the same direction comes from electric installations, for, after all, the driver of an electric vehicle has it in his power to maltreat it as many dollars worth, though not so visibly, as his colleague on the perch of a gasoline truck may injure the mechanism in his charge.

In the small gasoline vehicle installations referred to it is not fully acknowledged, either, that driving and care-taking must necessarily be two jobs. On the contrary, the driver, being the person who is nearest to hear the sounds and notice the other indications of imperfect operation, is considered the best man for inspecting, cleaning and adjusting his vehicle in the evening and for renewing the gasoline and oil supplies. The line is drawn at repairs, but somewhat more is expected of him in the way of indicating the need of them than in the case of the electric driver. It is pointed out that what is called caretaking in the case of electric vehicles, especially the testing and washing of batteries, replacing of defective cells and even the charging operation and grading of the electrolyte, comes more nearly under the head of repairs, requiring thorough technical understanding (for determining the necessity though not for the labor), than anything the gasoline vehicle driver is expected to do.

It is true that in these minor establishments where those who were previously drivers of horses have been successfully trained to tend and groom motor trucks as well as driving them, the owner is, as a rule, a man who is fairly competent as a supervisor and personally guides his men. He does more; by personal contact with them he forces upon them a sense of responsibility, which is frequently lacking among the drivers for larger concerns.

This seems to be the important point. When the sense of responsibility is produced, the teamster as well as the grocery boy can learn and does learn. The question is how to produce it. By personal pressure is one way, adapted mainly for small concerns. In the case of large installations, the owners and supervisors of which have usually been induced to learn what they know on the subject through their self-interest, it lies near to suppose that self-interest should also be made the inducement on the driver.

There are many instances on record to show how truly Newtonian, Edisonian or at least human has remained the capacity of a "common teamster" for learning all about valves, gears, clutches, and similar simple things, if only his self-interest is enlisted. The self-interest even expands occasionally into a real intellectual interest, showing what the man might have become if he had not happened to become a teamster. Probably nobody had ever taken the trouble of interesting him before.

So long as the General Electric Company at the shops in Schenectady, N. Y., paid a weekly wage to the driver of an experimental 5-ton gasoline-electric truck, whether the truck was in the repair shop or at work, troubles were numerous and frequent, but when they threatened to lay off the truck and discontinue the job, unless an improvement took place, the vehicle ran steadily for three months, when the driver, having learned something, got a richer job and quit. (His wages were only $10 weekly).

Where teamsters have been successfully trained to drive gasoline vehicles the chief cause for worriment over the driving question has been the ease with which the quondam-teamster-now-chauffeur—and more reliable and careful than the majority of those graduated from the pleasure-auto-garage—could obtain a job at better wages with the owner of touring-cars. This, rather than the severity of qualifications which is fictitious, has tended to keep the wages of gasoline truck drivers at a relatively high level. The tendency to make a liveried servant out of the pleasure vehicle chauffeur is rapidly making itself felt in the opposite direction, however, and may probably be relied upon in course of a short time to bring about as sharp a division between the two classes of chauffeurs as exists between coachmen and teamsters.

A hardware company of Pittsburg is one of the concerns where the self-interest of drivers was enlisted for maintaining the reliability and reducing the cost of service, at first for electric truck work, but subsequently also for gasoline truck work. The owners' keen understanding of the requirements helped to materialize the system in which the docking of pay for time unnecessarily lost through troubles with the vehicle soon brought about a condition that meant regularity and economy, though not without demonstrating the necessity for having the owner's part of the work done right before the driver could be expected to do his share. Selection of vehicles suited for the work, the avoidance of overloads and overtime on the road, frequent charging of batteries, double sets of batteries, sand boxes at the wheels for traction on slippery days; a glass front to protect drivers' eyes and thereby minimizing chances of accidents in the traffic, and a good equipment with spare parts, exemplify the nature of an installation where high demands may be made of drivers without creating their ill-will and dissatisfaction with the terms of the work.

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In a few places in New England, and probably elsewhere, docking of drivers' pay for vehicle troubles has been supplemented with a system of premiums for high ton-mileage, and this is said to have worked out well also, though *The Power Wagon* has not at present any definite data available on the subject.

While the question of drivers is one which personality and locality may shape and twist into many different kinks too subtle for analysis or classification in a general way, it is apparent that it *has* been solved in many instances, consequently that it can be solved in nearly all other instances by the display of equal ability in the management; further, that time and all the forces at work in the industry as well as in the motor vehicle labor market tend toward simplifying the driver's work and multiplying the number of those available for discharging it creditably.

One special feature in connection with the driving of power delivery wagons, express wagons and trucks has appealed strongly to many users of the merchant class. It is this. The ordinary driver and teamster becomes accustomed in emergencies to impose upon the animals in his charge mainly by violence, and there is gradually generated in him a spirit of recklessness and gratuitous self-assertion which does not serve business interests in the other work he may have to do, such as the delivery of the goods, soliciting of orders, observation and reporting of new local chances for business, and so forth. When the same driver or teamster has been trained to conquer the power wagon in his charge by obedience to the natural laws governing its operation rather than by brute force, he becomes at once a better man for the rest of his work, and by far more valuable to his employer.

At this point a new labor-saving element in the employment of power wagons frequently crops out in the form of dispensing with a special attendant for doing the commercial part of the work incidental to the service.

And not only customers but parcels are handled with more care, system, consideration and forethought by the operator of the machine than they formerly received from the unregenerated wielder of the whip and yanker of the reins—be the two persons even identical in the flesh.

VII

A Factor in Business Control

ONVICTION of the power wagon's economical value is one thing, and a spontaneous longing for just such a factor in the conduct of business as the mechanical vehicle seems to be, is another. Frequently this apriori disposition in favor of a mechanical transportation system is observed in business men in whom a reasoned conviction of their fiscal importance could not possibly have taken root; nay, in business men whose experience with touring cars would naturally lead them to believe that hard, rock-bottom economy was far off in all motor vehicle affairs.

Faith in the eventual victory of machinery over muscle and tendons in any kind of work may be resolved into succession or combination of simple motions, may furnish the explanation, perhaps, but there is another explanation which explains more and more deeply.

As an explanation it has the flaw of needing, itself, to be explained.

It relates to the fundamental principle for combining success with a comfortable feeling of security and mastery in the conduct of a large business. *Centralization of authority* is the name of this principle, and the power wagon serves to perfect its application. Arbitrary authority cannot be centralized. Orders conflicting with the nature of things are subversive of the authority that issues them. So there is no question of arbitrary authority, but of an authority which commands compliance by its good sense no less than by the power behind it. Organization means little more than a system securing the radiation of sensible orders from the nerve center of a business to its back, its fingers, its feet. The power wagon—unlike living fibre—is subject to *known* laws, and therefore fits into organization; fits better the more perfect the organization.

An owner may order a truck and team from a cartage company to appear within one-half hour, but if the cartage company's trucks are all engaged, he may not get what he orders for four hours. The barn-boss may order out a sick horse for hard work, but it won't go out, or, going out, will die or fail to do the work.

The recent growth of the trucking companies which guarantee to deliver in front of the merchant's loading platform so-and-so many transportation units every morning, or subject to advance order, is traceable to the increasing demand among merchants for a transportation system which will not bother them and upset their disposals of current business matters. The certainty which a contract with a trucking company affords commands a heavy premium.

(And the trucking companies, may it be said in parenthesis, are not slow to see that in order to protect this premium, they, themselves must adopt the power wagon and develop its utilization on a plane of thorough economy which will permit them to continue to offer inducements to the merchant).

Listen to the musings of a big business man who operates his own transportation plant with horses-and-wagons!

The hostler has reported "something" to the barn-boss, the barn-boss to the shipping clerk, the shipping clerk to the traffic manager, the traffic manager to the owner. The telephone to the trucking companies has brought no relief. Relief is for regular customers only.

"Can't be done, eh? Maybe. I'd like to know, though. Unforeseen circumstances! Oh, yes, they are always unforeseeable. Wish *I* could have that excuse." (A jarring note of discontent and anxiety, interfering with business, is by this time vibrating all the way from the owner's sanctum to the stable boy and to various concerns on the outside of the firm's organization).

The musing continues:

"We can control our business in every other way; but the stable, no! It is a bother. The whole horse business is beyond control. There are no data, no cash register plan. All the way up—hostlers, foreman, veterinary, drivers—all is mystery and bills—and we pay. What good would it do me if I were a horseman? *I* would not have time to take care of it, and goodness knows if I could do it any better, anyway. It is a vexation!"

The question of business control, and not the question of economy, is uppermost when something goes amiss, and at such moments the thoughts of the owner, turning to power wagons, are likely to dwell fondly upon the fact that steel, machinery and engines *are* subject to organization, that someone *can* be held responsible for the operation and daily condition of machinery, and that, whatever may be the *cost of learning* the proper use of power wagons, it is *intrinsically possible* to make them an obedient, co-operative element in a business system.

Without this charm the power wagon's justification through economy might often be more difficult to prove to the satisfaction of a business man than it is. Once perceived, this same quality of being thoroughly subject to the owner's intelligent disposals, opens a market for power wagons independent of their direct economy. The direct economy, accomplished by a good system of maintenance and utilization, is "thrown in" on top of what is in itself a sufficient inducement—indeed, the same inducement offered merchants by cartage companies hauling merchandise on the yearly contract plan.

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VIII

Tires and Other Buffers

GRUMBLING about tire cost and tire maintenance cost is epidemic among power wagon users. Only those inoculated with the pure virus of "money-madness"—so far as getting the most out of power wagons is concerned—are immune. To them the rubber tire is only a means to an end. It pays for itself and more; that is all they want to know, so long as they cannot find out just exactly how well it pays or that something else pays better. Neither the wonder-working machine of the future, the amateur's pet, nor costly pioneer work in developing rubber tire substitutes, has any charm to them versus the actual economy of the present equipment.

The other power wagon users, not yet inured to the systematic view, look upon rubber tires as something apart from the vehicle to which they are fitted, something which should justify itself and its cost by itself and its visible service. From this point of view they naturally resent the expense more or less, because the service is not visible nor perceptible to the tactile sense, the sense that realizes shocks or their absence, in any form that readily spells anything more pecuniary than comfort to the financial mind.

The justification of the rubber tire lies, of course, in the fact that it makes dollars by permitting increased speed and saves dollars by reducing maintenance and repair cost for the rest of the vehicle. Its special traction qualities are of secondary value.

Nobody knows just how profitable it is to use rubber tires rather than the much cheaper iron or wood tires. The profit must vary greatly with the speed requirements, the road conditions, the construction of the vehicles. It would seem that it should not vary much with the weights and loads, since the size and cost of tires, on one side, and the cost of, or profits from, transportation, on the other side, should be somewhat in proportion to the weights and loads; but the fact that rubber is an "unmechanical material" whose resistance to chipping, wear and disintegration cannot be varied over as wide a range as the conditions causing such chipping, wear and disintegration, complicates these considerations greatly. By judicious admixtures to the rubber much has been done to simplify them, however, especially in the case of solid rubber tires.

It has become practically accepted that one pound of solid rubber tire to each thirty pounds of loaded-vehicle weight is the standard requirement for most economical results, and from this basis the chemists try persistently to enhance the economy further by such admixtures to the pure rubber as will not only reduce the first cost but also improve the wearing qualities.

Both the wear at the tread and the equally important chafing action at the line of the tire's attachment to the rim are found to be in inverse proportion to the diameter of wheels, so that the pound rating holds approximately true for all wheel sizes.

That the larger wheel diameters save vehicle repairs, in addition, especially on rough road surfaces, is another matter.

The pneumatic rubber tire has all the advantages of the solid rubber tire except reliability, but the possibility of punctures and of neglect in regard to their proper degree of inflation has operated almost decisively against their employment for business vehicles, though under ideal maintenance conditions they are not considered more expensive. Their value as buffers against *lateral* shocks, in comparison with the value of new solid rubber tires in this respect, is also somewhat in doubt, so far as heavy loads are concerned requiring a high degree of inflation.

That the lateral cushioning afforded by rubber tires is their most important function in protecting the machinery which they support, and the function most difficult to get performed by any other means, is becoming more and more widely recognized.

The chafing action at the attachment of solid rubber tires is caused mainly by the tire's resistance to such lateral shocks and shows how important is the service rendered by concentrating the effects of these shocks in the rubber rather than in the engine, running gear or vehicle body. The recent employment of twin tires on heavy trucks is recommended largely by the fact that this construction softens the lateral cushioning, while holding the bulk of the tire down to a minimum. It is also this action, so important on cobble stone pavements, frozen, rutty roads and lumpy road surfaces, generally, which is commonly overlooked by the experimenters who propose pneumatic hubs, improved spring construction and other obvious cushioning expedients as substitutes for rubber tire action. Valuable as these expedients, in their best forms, may be for assisting in absorbing vertical shocks and thereby also contributing to longer tire life, they have so far all failed to relieve the tire of its main work; that work against irregular lateral jolting which wears tires most and thereby attests their purpose and their value. The only feature in construction which really accomplishes something to help the tire (and its owner) in this respect is the flexible frame design commonly known by the term of "3-point suspension," which assists the vehicle in conforming to the irregularities of roads.

* * * *

As already emphasized, solid and pneumatic rubber tires earn their cost by absorbing those shocks in transportation work whose main direction is lateral, toning them down before they reach wheels, engine, gears, vehicle frame, vehicle body, driver and load. The tire's capacity for absorbing the up-and-down shocks and stresses may to some extent be duplicated by other cushioning devices, especially by suitable vehicle springs—though even at this point the rubber tire offers the advantage of being always ready to receive and absorb a jolt while the benefit of springs is greatly reduced, in the frequent case of a quick succession of jolts, as from "chug holes," by their recoil or jouncing action—but no substitute has as yet been found for the rubber tire's lateral cushioning effect.

What this means in saving of wear and tear upon rolling stock is perhaps best realized by observing the violent swinging of the pole of a heavy truck proceeding over rough pavement, which sometimes throws a horse off its feet, and which is caused by lateral jolting exclusively.

The importance of lateral jolting is also illustrated in the popular favor accorded the platform type of vehicle springs. This should probably be ascribed very largely to the comparatively slight lateral cushioning which they afford through the shackling and the limited torsion of their side members. Even the semi-elliptic spring suspension gives a little more latitude in this respect than the full-elliptic, the latter throwing practically the whole brunt of lateral shocks upon the rubber tire, while in return yielding a more finely graduated cushion effect for absorbing vertical variations than any other type of vehicle springs.

[That the choice between the various types of springs is often dictated by considerations which have nothing to do with their fitness for absorbing either regular or irregular strains, but more with the height of the vehicle body the size of wheels, etc., is another matter.]

As a really efficient sideways-buffer the rubber tire stands practically alone.

All considered, the new solid rubber tire may be superior to the pneumatic tire in this branch of usefulness, but doubtless the pneumatic tire is superior to a solid tire worn down close to the rim, and in this connection the suggestion is forced upon the mind of those who pay the bills whether the armor bands so frequently employed to protect pneumatic tires against punctures (and to secure traction) would not be economical on solid tires as well, by preserving their lateral elasticity. The undisputed difficulties of attaching armor bands to solid rubber tires may perhaps be solved if those who pay the bills consent to see the advantages which should justify the extra cost.

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The suggestion, as just presented, comes from a user of power wagons and it is mentioned here as an example of one of those proposed improvements which seem highly plausible and absolutely fairminded but which are nevertheless farther from realization than first blush of thought would judge. In this particular instance the obstacle is perhaps not insuperable, consisting mainly in the fact that the chafing at the tire's attachment to the rim would wear the tire out quite as fast as without the armor, so that the extra cost of the latter would not be compensated for by longer life but solely by the extra protection afforded the vehicle plus a somewhat enhanced value of the rubber in the discarded tire. The proposed improvement has the rare merit, however, of nowise blocking an accurate understanding of the economical value of rubber tires, such as they are today, or interfering with their employment.

As said, the rubber tire performs what no other cushioning device in existence or in sight will do: Saving the vehicle from the natural effects of lateral racking.

On the other hand, all cushioning devices help to save the rubber tire in some form or other, and in proportion as they save tire cost they also aid the tire in its work of money making and money saving, just as one spring in carriage construction helps out another spring with which it co-operates.

All the cushioning devices or buffers in power wagons are therefore undoubtedly entitled to careful consideration by manufacturers and users. Springs, recoil-absorbers attached to the springs, brass plates under rivets, fibre or wood washers under bolt heads, flexibility in the suspension of rigid machinery units—are all allies of the rubber tires and allies of economy in power wagon maintenance.

At no other point in power wagon construction is enhancement of efficiency so beautifully entwined with cost reduction as in the interaction between tires and other buffer devices. The necessity for such interaction is specific for power wagons.

It is worth cultivating; cultivating with a view to ultimately reducing the maintenance cost of power wagons to the level of normal maintenance cost for stationary machinery of similar construction.

A very interesting step toward this theoretical ideal is embodied in the various anti-shock devices designed to be attached to vehicle springs to deaden the jounce. Their American development has departed from the original Truffault friction device which is simple and clever—being not nearly as irrational as it looks—in favor of hydraulic or pneumatic checks upon the spring rebounce. No more practical way of grafting experimental pneumatic suspension upon the established spring suspensions could be imagined. Eventually it may lead to more fully developed forms of air cushions by which tires may be relieved of their hardest work—laterally as well as vertically—and their life prolonged.

It is the speed and value of power wagons which renders the cushioning vastly more important than in ordinary vehicles. The loaded power truck going twice as fast as the loaded truck drawn by horses receives in a given time of travel twice as many shocks each of twice the intensity. The time for recovery of the equilibrium of the cushioning devices between shocks is reduced to one-half. The same consideration holds true, of course, in a comparison between power wagons operated at different speeds.

Taking number and intensity of shocks as the measure of the severity of service, the truck traveling six miles per hour receives a treatment four times as severe as a truck traveling only three miles per hour, if the weights and loads and roads are equal.

The economical dangers involved in overspeeding, particularly with overloads, must be evident, but a certain degree of speed is essential for profits, and there is a reasonable limit for the dead weight and brute strength in vehicle construction.

The tires and other buffers must bridge the alternative, must render it possible to save at the spigot of speed-advantages and at the same time prevent wasting at the bunghole of maintenance cost. It would be difficult to overrate the importance of this function.

IX

Assortment of Vehicle Sizes

ALL owners of transportation plants are familiar with the ever-recurring question of vehicle sizes. It bobs up every time a new wagon must be purchased. Theory invariably pushes for large size and capacity, and minor practical necessities invariably cut the theory in two. The struggle is between the ton and the mile, with "first cost," "fixed charges," "empty returns," "loading time," and a swarm of varying business considerations holding the balance of power. If the theorist were in the habit of according the proper money value to speed, he would not be so sure that large sizes were preferable, but the proper estimate of the speed value is only coming slowly to its rights with the advent of the power wagon. Every thought relative to first cost and fixed charges, if drawn from experience with horse-and-wagon service, will need to be remodeled. To decide whether two 1½ ton or 2 ton wagons of 6 to 8 miles average speed may be bought and operated at a cost and a profit comparing favorably with the cost and profit from purchase and operation of one 3 or 4 ton truck of 5 miles average speed, is no child's play, and it would be futile to contend that any data have been gathered by power wagon users which would assist others in reaching the best possible decision. The difference in speed should certainly always be carefully considered in the estimate.

A complete survey of individual business conditions and a searching examination of what the power wagon industry offers in the way of prices, sizes and guarantees, seem to be required in each case.

And here is where the expert should step in with a helping hand and an unbiased mind, versed no less in the horse-and-wagon system than in the ins and outs of power wagons. Without familiarity with the best in the past it would be difficult for him to recognize the requirements of the present and of the future.

Unfortunately, available experts are few and far between.

One guiding fact is noted, however. There is a distinct tendency toward employing power trucks of smaller load capacity than that of the horse-drawn trucks previously employed in the same business. Repeat orders from power wagon users also tend toward smaller sizes. This tendency seems so much more remarkable as the speed of power trucks does not decrease so rapidly with increasing weight and load as the speed of the horse-drawn truck.

Apparently it has been found by experience that certain relations exist between routes, distances from headquarters, practicable speeds, loading time, working hours, price of vehicles, maintenance cost and the need of reserve vehicles for emergencies or rush work, which—all comprised in one difficult mental grasp of a situation—argue for vehicles of capacities from 1 to 3 tons rather than for the larger sizes, unless the business requirements leave no doubt in regard to the regular daily need of vehicles carrying 4 or 5 tons or even larger loads.

There seems to be room for suspicion, however, that this empiric finding in favor of the smaller sizes may be less universally valid than the unanimity of the American records would make one believe. From England, France and Germany come reports favoring 6, 7, 8 and 10-ton vehicles, usually steam trucks operated with or without trailers. Perhaps average road condi-

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tions in this country affect the size of vehicles more than all the other factors combined, and perhaps the limitations imposed by these *average* road conditions have affected the industry to such a degree that the opportunities for obtaining the largest sizes of power wagons have been contracted.

Rash inferences from the fragmentary experience at disposal are plainly unjustifiable in the maze of considerations that bear upon the subject. Those who have work for power wagons over roads of known and permanent quality, permitting a relatively high speed for the heaviest loads with power wagons (while not permitting any similar increase in the speed of horses), and who naturally would desire the largest load capacities obtainable, should probably not be deterred from securing the sizes intrinsically best adapted for their work.

This is mere reasoning. Readers of this publication, consisting mainly of principals in mercantile establishments of some magnitude, are fully capable of doing their own, when the *new* material needed for completing the reasoning process is furnished.

All such material, really on record and available and bearing on sizes of power wagons, is believed to have been given or implied in the foregoing brief remarks. To apply it to the questions which arise for each user of power wagons with regard to the best *assortment* of vehicle sizes in a large installation and with additional regard to the bulk capacity of the vehicles, must be left to the judgment of him who in each case knows the needs of the business to be served.

Examples from power wagon practice during the past few years might be instructive if available in complete, definite facts and figures. But they are not so, pointing only vaguely to a certain danger of having bulk capacity abused by overloading and to a certain advantage in supplementing an installation of heavy electric trucks with gasoline vehicles of smaller capacity and greater speed.

X

Load Capacity Ratings

SO as to be more easily understood by its customers, the power wagon industry has sold its vehicles with the load capacity ratings expressed in the same terms and on the same scale as are used in the classification of ordinary wagons.

The result seems to have been a misunderstanding. The industry was too accommodating in attempting what could not be done, and the users took for granted that it could be done.

Broken springs, sprung axles, twisted frames, wrenched tire attachments, rapid wear of misaligned bearings, burned out armatures and probably several other troubles have attested the misunderstanding which sprang from a desire to be understood. They have also removed the misunderstanding, but at an unnecessary cost and not quite generally. There are still many who assume that a 1-ton electric or gasoline truck may be loaded with 2 or 3 tons occasionally without harm, just as a 1-ton single-horse truck may be loaded with 2 or 3 tons occasionally if the horse can pull the load.

As a matter of fact. the power trucks and delivery wagons have been built with fully as high a "factor of safety," or surplus carrying capacity beyond their rating, as horse-drawn vehicles of the same rating. When standing still they would support their overload without creaking, squeaking or yielding abnormally at any point in their construction. They would continue to bear up at horse speeds. That justified the rating and the Pickwickian sense in which it was accepted, meaning as much more as could be conveniently piled into or onto a wagon of the particular class and description referred to in each case.

In practice, however, the power trucks and delivery wagons were not limited to horse speeds, but were driven much faster, whether overloaded or not. As pointed out in another section (Section VIII) double speed means shocks and strains of at least double intensity and twice as many of them in a given time. The rating had not been formulated with these quadrupled strains in mind. The "factor of safety" and the tires did not always take care of them fully.

The horse is to a certain extent automatically checked by an overload. What its nature fails to provide—when going downhill, for example—the driver accustomed to his work does for it. The speed that "goes" with the load capacity rating of the vehicle "goes" without saying.

With power wagons there is no similar automatic speed check. Under a number of different circumstances they can be driven very fast with a large overload, and a horse-vehicle load rating accompanying speed limitation is therefore misleading.

One or two manufacturers of power wagons have discarded the horse-vehicle rating system and adopted instead the railway system of rating each vehicle according to the maximum load. Their ratings are nominally higher, but their customers are supposed to understand that overloads are not admissible. It is doubtful whether they also stop to consider that the railway companies can afford to neglect the speed factor, or at least need only consider it summarily, because the smoothness of rails and the comparative insignificance of gradients greatly reduce the range of stresses to which their rolling stock may be subjected. If the maximum rating system for power wagons is practically based on static load in the same manner as in the rating of railway freight cars, it does not seem to offer any much greater guarantee against misunderstanding and abuse than the common system or lack of system inherited from horse-and-wagon service. The power wagon user is in both cases thrown back upon his own and his drivers' discretion.

A conscientious driver will consider load, speed and road condition, all in one, and the best rating system is the one that starts with cultivating the driver's judgment and self-control.

XI

High Pressure Installations

KEEP the motors hot, the batteries charged and discharging!

An idea which was bound to come to the surface sooner or later has already dawned upon the delighted vision of a few managers of road transportation systems who are well advanced in the art of energetic and economical maintenance of power wagons.

The leading thought is simplicity itself. Only this: Use your power wagons all the time, day and night, and at the maximum speed consistent with traffic regulations. Have your machine shop and your expert repair men at your garage instead of at the factory where the wagons were made. Foresee all possible troubles. Never delay repairs or replacements. Work day-and-night shifts of drivers and garage help. Standardize your vehicle equipment. Do the work of ten power wagons with four or five. Vary the nature of the work, if by no other means you can expand the volume. Haul dirt, stones or brick at night, if necessary, and passengers or merchandise in the daytime, as some of the trolley lines do.

* * * *

Patiently the power wagon submits to this treatment and

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even promises to thrive by the change. Now, finally, it is sure of careful attention.

The idea has the same charm as high-pressure dairying, cattle feeding and agriculture with their manifold expenses for machinery, ice, stable buildings and oil cakes, costly manure, hot water pipes, tiles, glass roofs, etc. The expense is much higher, but so are the receipts.

In the present instance the crop is transportation.

* * * *

It is not for a moment supposed that all power wagon users can, or should try to employ high-pressure transportation methods, but these methods are among the new means placed at disposal by the power wagon for rapid expansion of an express or trucking business, almost independently of the limitations of space and location which handicap many a growing concern. With the aid of high-pressure power-wagon methods pure energy will be able to provide for expansion of business volume in a manner never before dangled before the dazzled eyes of the transportation-business manager of bounding ambition.

The saving in capital investment, the saving in rolling stock, space and rentals comprise not all the inducements on the economy side. Neither is the hope of rapid business expansion the whole inducement on the profit side. By using few vehicles and using them at a pace that would kill anything but a repairable organization of steel units in double quick order, the owner hopes to pay for the vehicles as well as for their strenuous maintenance practically out of his business profits and he figures that by wearing the vehicle out rapidly he will be in a position to take advantage of all progress in construction without being obliged to discard serviceable rolling stock.

Probably there is not a single concern in this country which has reached to a deliberate high-pressure system, but there are many which under high pressure have used their power wagons extravagantly and have recognized that such use carried its own punishment with it, unless a high-pressure maintenance system were at the same time adopted. To install a high-pressure maintenance system has, so far as known, in all cases proved a difficult matter, for the reason that it was not contemplated to continue the extravagant high-pressure use of the vehicles beyond the rush season, and the incentive for doing the thing systematically was therefore lacking. The experience was commonly that of a hustling department store.

Acknowledgement of the possibilities has not come from their full realization in any one place but by piecing together bits and fragments from everywhere. Nevertheless, the sentiment created has been strong enough to carry conviction in some quarters not only of the necessity of high-pressure maintenance with high-pressure use but of special virtue and economy in such high-pressure maintenance, arising presumably from the tendency of a strong system to gather strong men, capable of putting better as well as more work into the maintenance.

In England, where power omnibuses are operated with so much success that the industry is not able to supply the demand, the omnibus companies have been forced to keep the limited number of vehicles at their disposal in constant commission, in some cases including all night service, and one of two things happened. Either they succeeded in keeping the vehicles going by organizing the maintenance on the high-pressure plan, or they failed in the latter and the service was crippled, and, if the financial resources were not equal to providing new vehicles to take the place of the percentage in the repair shop, or none could be had for love or money, the companies went to the wall. These British conditions in the field of public service vehicles embody probably the best schooling for high-pressure power-wagon employment, and the results accomplished in some cases—according to the British power wagon journals—go far to prove that "there is money in it" if it is done right, even if the origin of the system was sheer necessity.

Without being able to define all that a high-pressure transportation system would involve, but merely to point out that a movement toward such a system is clearly discernible here and there and at present working out its own salvation by the cut-and-try method, *The Power Wagon* deems it advisable to draw attention to the interesting possibilities, more particularly in view of the shortage in the supply of power trucks, stages and omnibuses which very probably will be experienced in this country within a year or two, or earlier.

XII

Garages, Public and Private

DURING all the past years in the development of motor vehicles the profits for the owners of public garages have been distinctly in the foreground in everything considered in the arrangement of garage work, while profits for the owners of the wagons entrusted to their care have been not only in the background but considered as almost diametrically opposed to the interest of the garage men. It would be insanity to expect satisfactory results to the owners of trucks and delivery wagons under these circumstances. Yet such has been the pressure caused by the absence of information on the part of power wagon owners and by the scarcity of competent help for the proper maintenance of their property that probably one half of power wagon owners have actually had their vehicles cared for in just such public garages. With what results may be imagined.

The pleasure vehicle was in practically all instances the backbone of the garage business. The principal profits were derived from them and from the troubles caused by reckless, speedy and incompetent driving. The shortcomings in intelligence or character of the pleasure vehicle owners constituted the capital of the garage owner. He drew heavily upon it, and frequently overdrew. Matters of speed and racing formed the subject of the attention and talk of all the light-headed helpers in these establishments. The washers and often the drivers were recruited from messenger, elevator and bell boys, newspaper carriers and sellers. The tone was usually that represented in the lowest class of the press. According to it every automobile owner was a "swell guy" to be exploited. Considerations of economy did not thrive in such surroundings. There was no room for decent regard of the interests of customers occupying the exceptional position of operating motor vehicles for profit and economy rather than for elegance and ostentatious expense.

Now, that the motor vehicle users have nearly got through sowing their wild automobile oats, a change in the garages is following suit but the improvement is one in the decency of the tone rather than in the deepening of the understanding of economical principles. The latter are still in constant jeopardy in the too close proximity to Tom's, Dick's and Harry's 50 horsepower, one-mile-a-minute touring car. Whatever progress has been made in the art of keeping trucks and delivery wagons in constant commission at a minimum of expense has been due to work initiated and tried out in private garages forming the maintenance stations for some large merchants' or corporations' installations of power wagons; although it should perhaps be admitted that a few rich men owning stables of 5 to 15 pleasure automobiles have contributed not a little by showing what a model garage for such vehicles may be made when cost is not considered. The improvements introduced in those few private stables of this character have doubtless suggested improvements fully available for the economical power wagon station.

As the pleasure automobile is still very much more numerous than the commercial motor vehicle and promises to remain so

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for considerable time the public garage gives little more promise for the future than it has redeemed in the past.

Owners of the commercial motor vehicle must look to the establishment of private stations if they shall hope to accomplish the best results.

Or, they must rely upon co-operating with other owners in a similar position with themselves for the maintenance of garages under competent foremen directly responsible to the various owners. Among public institutions that give any promise of equal results only two kinds seem worth mentioning. One is the power wagon garage operated by cartage companies who are fully accustomed to meet the business wants of their customers, and the other such garages as may be established here and there by the manufacturers of power wagons to watch over the welfare of the vehicles which they have sold.

As it is manifest that all garages must be made to pay, for their owners as well as for their customers, every step taken in the industry for enlightening garage people upon the best methods for rendering their institutions profitable by legitimate means is naturally in the interest of vehicle owners as well. It seems therefore a favorable indication that one of the manufacturers of electric vehicles has lately published a highly interesting pamphlet setting forth the manner in which electric garaging can be made profitable. It has been a prevalent opinion among garage men that more profits could be squeezed from the owners of gasoline vehicles than from those of electric vehicles but a peep into the inside of this opinion seems to reveal as the main reason for its existence little more than the prevalence of malpractice in creating unnecessary costly repairs on gasoline vehicles solely upon the strength of their owners' lack of information or reckless use of their own property.

Another indication of what may be done by the manufacturers connected with the motor vehicle industry is furnished in the case of one make of storage batteries for which repair stations with specially skilled help are maintained in nearly all of the large cities, invariably resulting in securing the lion's share of the electric garaging in each locality.

Altogether there is no denying that the arrangement of garages as well as the maintenance work to be undertaken in them are matters still in the infancy of their development, fully five years years behind the evolution of the vehicles themselves. Gradually, however, information and skilled men are being produced in ever increasing numbers from the few places where the work is done well, and neither merchants co-operating with one another nor cartage companies should now have much difficulty in finding persons fully competent to oversee their establishments, while the small private station may in most cases be supplied with a competent man sent out from the factory where the vehicles there maintained were made.

How the arrangement of the garage should be and just how the work should be done in each case may not be said in all generality, but only in a series of complete descriptions and illustrations of power wagon stations actually in existence and conducted with more or less approximation to ideal results. Such descriptions and illustrations this publication will place before its readers as fast as the material may be gathered. Taking even the most advanced establishments of this nature as models, it is impossible not to realize that many features remain to be worked out before a finishing touch to true economy may be said to be accomplished. It is still too common to store electric vehicles "as thick as they will stand," and that such could be done was actually brought out as one of the excellent features in electric vehicles in an advisory article appearing recently in a commercial vehicle publication, notwithstanding that inspection and adjustment at the right time become a practical impossibility unless each vehicle has its own allotted space with a sufficiency of room around it. The two-story garage has been developed in Europe to a finer point than here, it seems, and matters of insurance and of real estate economy remain to be looked into more closely than so far has been the case. One highly important point, namely, the right equipment with machinery and tools according to the nature of the installation, has so far apparently been left to a purely haphazard judgment without any attempt at systematic calculation of the chances and probabilities.

The equipment with spare parts for replacements, while perhaps the most vital detail in the arrangements of the private station, is necessarily a matter in which a garage owner, as such, could not be expected to interest himself, if he has vehicles of many different lines of manufacture under his care. It is mentioned here on account of its supreme importance for keeping power wagons uninterruptedly at work and because, in providing for an installation, it is one of those features requiring some correspondence with the makers of the wagons. The manufacturer knows, as a rule, in what order, approximately, wearing parts will require replacement, and will supply the spare parts with the machines if requested to do so.

All of these considerations will require interchange of knowledge, experience and opinions between power wagon users and foremen of installations during the next few years.

XIII

Trucking and Express Companies

NECESSITY being the mother of invention, whatever there is of invention in using power wagons right, in devising and following the system that will get the maximum of profits out of them, must crop out sooner or later in the business of express and trucking or cartage companies, since economy is vital to their commercial existence. All the profits they make must be made out of transportation as such. Compelled to make profits, they *will* make them; and it will be the privilege of other power wagon users to observe and note what these professional transportation companies do, in order to learn with the least possible exertion how to obtain the maximum results from their own installations.

Those among the express and trucking or cartage companies who have discovered the power wagon, in the sense of appreciating the role it must play in their finances, having once adopted it stick to it and gradually extend its employment into more and more branches of their service. No better proof of the power wagon's intrinsic economy even at this early stage in the art of maintenance could possibly be offered.

Mentioning examples, it may be recalled that the Parmelee Transfer Company of Chicago adopted electric vehicles in that early stage when neither the batteries were perfected nor the art of caring for them known. Naturally, the results were poor, and the vehicles, if memory serves us right, were scrapped. After a lapse of a few years, however, the same company has returned to power wagons under better auspices and continues to use them. Another Chicago express company, the Brink's, braves the pavements of the western metropolis with gasoline wagons and liberally proclaims their superiority over the old system. The Adams Express Company has for years experimented with modified constructions of all types of power wagons, steam, electric and gasoline, and now uses large gasoline trucks in some branches of its service and a much larger number of electric express wagons in a number of different cities of the country, apparently with extraordinary economical results. The United States Express Company has for the present declared in favor of electric wagons for the bulk of its work and seems particularly partial to the use of Edison batteries although the latter cannot be said to be openly in the market.

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In the case of all the express companies, when the question comes to the equipment which they use, there seems to be cause for great caution in drawing quick inferences for the reason that these large corporations are intricately entwined with other large corporations whose financial interests may dictate the use of one equipment rather than another without strict regard to intrinsic merit. Other power wagon users will therefore find it the part of wisdom, rather than to follow the example of any one express or trucking company in regard to types of vehicles or vehicle equipment, to obtain general information in regard to what all of them use in their various branches of business respectively, and to draw their conclusions accordingly.

One of the stumbling blocks to immediate success in the efforts made by large companies for adapting the power wagon to their wants has arisen from their corporate complications. Occasionally they have fallen victims to engineers with pet theories who manage to impress one director or another; or nephews of the vice president's sister-in-law have been appointed to jobs for which they were not fitted. Complaint of this peculiarity in corporate management of new branches of work has also been voiced strongly from England, where it seems to have been more prevalent than here. It soon yields to heroic treatment, but frequently has interfered with the economy of large corporations during the first period of their use of power wagons. It seems to be common to consider, in these circles, that a nice young man properly graduated from a technological institute and well connected socially is just the person to place in charge of such a new branch of work as the investigation and organization of a power wagon service, but the natural leanings and longings of this class of men has been abundantly shown to tend toward experiments in construction, toward a chance for glory rather than toward a certainty of economy, and the companies have had to pay.

In the 6,300 trucking and cartage companies operating throughout this country the field for the employment of power wagons is so immense that the industry can contemplate with complacency the loss of a few through such causes as indicated. At all events, there is always in each case a quick return to sound business principles as soon as the ledger shows what the favored young man of Titanic ideas costs.

The absolute necessity for making profits from transportation alone in the express, trucking and cartage companies, to which may be added in a slightly different sense the omnibus, stage and cab companies, suggest strongly to the power wagon industry to cultivate this line of customers more assiduously than any other. Self-interest competently directed will compel them to aid the manufacturers all they can, not only in regard to construction details but especially with regard to systematizing the methods of maintenance, and they cannot avoid spreading the required knowledge of driving and stabling methods among large numbers of employes, who will afterward carry the knowledge into wider circles and prevent other power wagon users from falling into bad ways. The start being already made in a highly auspicious manner by the largest companies of this character, there can be little doubt that competition will quickly force practically all of them to look into the power wagon question and to place extensive orders with the industry. In this prospect there is outlined perhaps the most ideal plan for safety combined with progress, inasmuch as the industry, as at present constituted, will have all it can do in supplying vehicles for these companies alone, as soon as they shall all have waked up to the new necessity in their business.

While believing that the transportation companies for natural causes will be the first to lay solid foundations for power wagon use in general, and—speaking mainly of the maintenance of gasoline vehicles and steam vehicles since electric practice is already well developed—in all probability will be so far ahead at at any given time on questions of economy and means for getting efficiency under specially difficult conditions, as to be able to offer their services to individuals to mutual advantage, there is no inclination to underrate the fact that in the aggregate the much larger number of brains among the merchant class will contribute a most valuable share to the common experience, especially in details relating to each of the numberless different forms of business in which the power wagon may be used.

Selecting, however, any one class as the most important customers, allies and friendly critics of the power wagon industry, the choice should fall on the transportation companies.

XIV

Municipal Uses and Service Stations

NEARLY everything that concerns the use of power wagons by municipalities for any other work than that of the fire department and the light rapid work of inspectors in the police and other departments lies in the future, and, as it is doubtful whether municipalities as a rule are bent upon labor saving or an excuse for labor extension, it is perhaps not to be expected that power wagons will be used extensively in any of the heavy and comparatively slow work which abounds in the sphere of municipal activities and ought to abound more.

The work of inspectors is done with ordinary automobiles and falls under that branch of power wagon service, but that of the fire departments is both heavy and fast, and the adaptability of self-propelled vehicles for it has attracted widespread attention followed by practical results. The economical side of it is thoroughly eclipsed however by the importance of reaching fires a few minutes earlier than possible by other means and of having the mechanical power of the vehicles at disposal for increasing water pressure and thereby sending streams of water to greater distances and greater heights.

The advancement made in Europe in the way of devising suitable self-propelled fire-fighting apparatus has been much more general and generous than here. The Vienna fire department is operated by self-propelled vhicles practically exclusively and the reports which have reached this country indicate a saving in the cost of the service which should immediately attract attention in every municipality where the question of cost is seriously considered. The reports of efficiency are still more favorable. In Paris, London, and in a number of towns in Germany electric, steam and gasoline driven fire department vehicles have been used with varying satisfaction for several years and, while the reports indicate continual changes in the construction looking toward better adaptation to the peculiarities of the work, they also indicate that any of the three types of power may be used to advantage so far as efficiency is concerned. In most places these vehicles are supplemented by the machines of the old system and an economical comparison is therefore practically impossible.

In most fire departments in the United States it is the ambition of the chief that his men shall use their ample leisure for keeping the fire-fighting apparatus in the pink of condition, and as the equipment includes chemical engines and a good deal of machinery bearing strong resemblance to that of the power wagon, more or less ingenuity and familiarity with ordinary repairs of mechanism is developed in the fire crew. This skill may of course be turned to account for the maintenance of self-propelled vehicles, and it should therefore be possible not only to reduce the maintenance cost to a minimum in the fire dapartments but also to keep its standard up to a very high level, with minimum of outside repairs. As a matter of fact, a large number of cities and towns in the United States are at present receiving estimates upon the comparative economy of the old and the new systems and generally seem to favor the innovation. A few of the manufacturers have also turned their attention in this direction and are offering

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nearly all the different types of vehicles required. The same may be said of self-propelled street sprinklers, and where accounts have been kept of the performances of the latter a considerable saving has been figured out. So far as known, however, the self-propelled street sprinkling carts are in all cases owned by the contractors who do the work and are not strictly included in the municipal system.

Much the widest employment of power wagons for municipal work would be that usually sorting under the street cleaning or engineering departments and relating to the removal of street sweeping and refuse and offal from the houses. But in this line absolutely nothing seems to have been done so far in this country although the city of Liverpool has used steam dump wagons for many years and is continually extending the service, and is imitated among other European towns. The extreme slowness which has been characteristic of the work of the ordinary wagons of this type and the necessity for exceedingly frequent stops are factors which seem to have militated strongly against the idea of employing motor power, but in reality these considerations should operate in the opposite direction, as the question of construction involved in fitting power vehicles for that class of service are by no means difficult of solution, once the problem is tackled.

For various reasons the majority of the dump carts used in street cleaning departments are drawn by one horse and its size and weight is selected with reference to its capacity for drawing a load of 500 to 1,000 pounds at a very staid gait which is not changed greatly when the empty wagons return to the loading places. Power wagons of suitable construction could profitably be made to carry 2 to 3 times as large a load as a one horse cart and to proceed at twice the speed, and with these large margins of superiority at the two most essential points, namely loads and speed, it should be easily practicable to figure out a substantial economy. The main difficulty would seem to lie not in the technical question but in overcoming the inertia of the municipal administrative machinery as well as the popular opposition to anything reducing the employment of human labor in public work.

An important point in the municipal work with power wagons would be the possibility for working at night with noiseless rubber tired vehicles, thereby reducing the number of the latter very considerably and saving valuable space in the service stations, as well as saving the population a good share of the annoyance now caused by the customary methods of executing street cleaning and renovating work. It should perhaps also be mentioned that the new facilities which would be placed at disposal by power wagons for reaching out from the center of cities, very much farther than before, would open up new possibilities in the way of disposing profitably of all sorts of refuse. Neither does it seem excluded that cities in some cases might undertake to remove dirt and rock from excavations by means of power wagons, working at night perhaps, dispose of such material at a profit instead of having it dumped at the nearest available spot, in river or sea, where those who own the material must frequently—as for example in New York City—pay for the privilege of getting rid of it.

While this look into future possibilities is based wholly upon experience with power wagons in work not municipal and is therefore in a sense theoretical, one additional important factor in favor of extending the municipal employment of motor vehicles should probably not be left unmentioned. The service stations or municipal garages could easily and economically be made of such a model character as to become the centers for spreading knowledge in regard to the care and maintenance of power vehicles throughout the city where located.

Unfortunately, however, all questions of economy, where municipalities are concerned, are somewhat confusingly mixed with the chances—varying locally—for securing the kind of administration which will make for public savings rather than for private profits.

Whether manufacturers should cater to private profits or to public requirements is a moral question not within the province of this publication, but, as to the public requirements, it has appeared on several occasions that one of the principal hindrances against the introduction of power wagons for street cleaning work has sprung from the peculiarity that the chiefs of departments were not in possession of any definite plans or drawings showing how it was proposed to apply motive power to wagons of the established type of body, nor of any general plan showing how vehicles of different body design might be used.

The problems of the work have not yet been attacked seriously by the industry.

XV

Public Service Work

THAT branch of power wagon work which relates to the transportation of passengers by public conveyances for some reason or other seems to appeal to popular fancy and popular instincts for profit-making more strongly than the more prosaic heavy transportation of merchandise or material in bulk in which the power wagon has so far earned its spurs in this country.

The boom in motor buses and other service motor vehicles which has already reached astonishing proportions in England—possibly by reason of local conditions differing from our own—threatens to be repeated here. This popular movement may be a force for good or evil, accordingly as it shall be directed. While there can be no doubt that the employment of motor vehicles in this branch of service can be made highly remunerative in very many cases, it is also evident, judging from European experience and from the natural order of things, that there is in many quarters a disposition to underrate the requirements in the way of analyzing the conditions before each enterprise is launched and in regard to the necessity for a highly competent system of vehicle maintenance.

Dealing in these articles exclusively or almost exclusively with data based upon real experience in this country, there is only one small branch of the public service work of which anything may be said positively. This is the service by electric cabs in metropolitan cities, and in this branch the experience accumulated up to the present date has not been uniformly in favor of the motor principle. The largest company engaged in this traffic in New York City is generally supposed to have made it profitable. After wrestling for a considerable period with an unusually heavy expense for tires the latter expense has now been reduced to reasonable figures, but nevertheless there is almost authentic information to the effect that the popular impression of profits is erroneous, although the fares charged passengers are higher for transportation in electric cabs than in those drawn by horses.

Among the general abundance of testimony for the economy of the power wagon this exceptional instance to the contrary is as conspicuous as a bandaged sore thumb on a pretty hand, and, as neither bad management in a mechanical sense nor highly unfavorable natural conditions can be alleged, an explanation of a different sort is in order. This explanation falls into two parts. The company referred to was in the first place heavily over-capitalized, taking an inheritance of this kind from the old electric vehicle boom of 1898 to 1900, and its financial situation was aggravated by the purchase of franchises in its early days, all of which resulted in the necessity of paying dividends on a wholly arbitrary and excessive capital not representing the real investment. Large expenses were also incurred during the first years, before the art of battery maintenance and garage organization had been mastered.

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Absence of profits may in thousands of instances be accounted for by such reasons alone. Hereto comes, however, that cab service and in fact any service that does not provide for the continuous activity of the power vehicles, involves a great waste of their earning capacity. The cabs are in actual use for only a limited part of each day, being subject to the call of customers, and all the time lost between calls is the loss of the high working capacity of the power wagon, while in horse drawn cab service the corresponding losses are so much smaller as the speed of the horse vehicle is smaller than that of the electric cab, and furthermore so much smaller as the rates charged are lower. Just what this consideration amounts to it is impossible to say without being in possession of a perfect schedule showing how often and how long each electric cab was employed during a period of service, but it is evident that the possible earnings of a power vehicle in schedule service may very easily be cut in halves under these conditions. The impossibility of controlling the speed of electric cabs by regulation—against the effect of the customers' tips to the driver—must also involve a greatly increased bill for tires and deterioration of the vehicles.

The company in question is nevertheless continually and rapidly increasing the number of electric cabs and broughams in service, demonstrating thereby that they fully realize that any economical errors in the past are not due to the motor principle but to the difficulties in management.

As before mentioned, the American experience with public service vehicles does not properly extend beyond this narrow sphere, but the number of omnibus and stage lines now in the stage of project is large. In many cases the reasons which have actuated the promoters of these lines may have been flimsy, and yet the project may be sound for other reasons not considered.

Looking for the causes of the incipient boom in motor buses and stages one finds a number. It is usually represented by the promoters that higher fares may be charged than for transportation by horse drawn vehicles. The aversion to granting franchises which has lately asserted itself, probably on account of the agitation for municipal ownership, has undoubtedly also much to do with the prevalence of the projects. The fixed charges for operating trolley lines and the large initial investment required for them furnish an excellent argument for the motor bus. Profits without investment exercise an irresistible charm. The large development of summer and winter resorts also has something to do with the matter. Many resorts in the North are owned by persons who also own resorts in the South. The motor bus offers the most obvious means for providing both with attractive means for transportation of visitors without a double outlay of money, by simply shipping the vehicles north for the summer and south for the winter. The growth of the touring spirit and the increasing preference for country residence promises a wider employment of motor buses than could have been thought possible a few years ago.

Among these causes the hope of securing double pay from passengers for the speed of the power vehicle is probably the most insidious, as whatever limited experience is at hand tends to prove that the class of passengers who patronize stage lines will give their preference to the fastest line, but will not pay for the extra speed after the novelty has worn off. In the long run, all public service enterprises must derive the special profits obtainable from the use of motor vehicles not from the passengers' willingness to pay for speed, but from their own service-economy due to speed. Double pay for speed cannot be permanently obtained. In other words, the public service enterprises must employ the speed which is most economical—by reason of the human labor saving as well as the saving in equipment which it involves—but must make a gift of this speed to its passengers.

Taking another leaf from limited experience here and in Europe, it is noted that undercapitalization is considered one of the greatest dangers for rural stage lines. With small facilities for proper maintenance, and often with a limited capacity for organizing it, just enough vehicles are bought to permit the company to operate on the schedule first laid out. Then, after some time, one after another of the vehicles is laid up for repairs, the facilities for performing which quickly are not at hand; and immediately the fatal interruption of the regularity of the traffic begins; capital for buying more vehicles instantaneously is unavailable or no vehicles may be obtained without lengthy notice to the manufacturer. The public gets tired of the irregular service, and directly the collapse of the company ensues, with public sale of its rolling stock equipment; going for a song to the lowest bidder.

In city service where the repair facilities are usually very much better, it is observed that nevertheless such factors as extreme noisiness of the vehicles, due to wear of gears, is in some cases allowed to disgust the public, besides causing the unduly costly repairs which always follow neglect to have minor repairs made in time.

It is often argued in favor of omnibus lines that they will prove a strong factor in improving the country roads. Undoubtedly such is the case, but investors will scarcely forget that this argument appeals to their philanthropy rather than to their purse, as the roads of the future will not save a poorly launched enterprise, now.

While dwelling here mostly upon the troubles which stage and omnibus companies may encounter, it should go without saying that, where the necessary requirements are complied with, all the excellent reasons for counting upon power wagon economy in ordinary mercantile work may of course be counted upon in favor of public service work as well, and will undoubtedly render profitable a good percentage of the projects now under public consideration. The troubles are emphasized here mainly with a view to safeguarding the interests of the motor vehicle industry as well as those of the public at large, which would be ill served if a large class of power wagons were allowed to go into highly conspicuous work under conditions which can only lead to financially disastrous results. It would perhaps be a good move on the part of the industry to refuse to sell public service vehicles without investigation of the conditions contemplated for their use and the financial resources of the companies who order them. Probably the industry could take this step absolutely without loss of sales at the present time and with great gains for the future, but unless the press of the country does its duty in emphasizing the true economical requirements for profits from public service motor vehicle work, public imagination will undoubtedly be fired to such a point of expectancy with regard to the benefits to be derived from motor buses, etc., that the boom will take its course with the usual ultimate results.

Wherever public service motor vehicles are to take the place of horse service one great advantage is to be noted in the fact that the faster the replaced horse service was, the greater must be the number of horses which can be taken out of action by the new system notwithstanding that the speed superiority of the motor vehicles is smaller in such cases than where they replace horses for heavy transportation of merchandise. The relays required in fast horse service with considerable loads constitutes so important a factor as to overbalance the speed comparison.

The large motor cars intended for operation on railway lines are often considered in connection with the subject of power wagons, but it is only the motor vehicle not intended to be operated on rails but purely as a feeder to railway traffic which properly comes under this classification. Railways which offer omnibus service from rural districts in order to gain patronage which otherwise might go to competing railways should constitute the very best class of customers for the power wagon industry. If they make mistakes in the maintenance, they are usually financially able to stand it; and having experience in the maintenance of locomotives they quickly learn to systematize the maintenance of any type of power bus which they may purchase. Their patronage of the power wagon industry is likely to be profitable to themselves and profitable to the power wagon industry, inasmuch as their treatment of the vehicles will not result in unmerited disgrace for the motor principle.

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XVI
The Agricultural Interest

OUT on the farm the ton-mile measurement in matters of transportation and locomotion is not looked upon with much respect; and possibly not with much understanding. A power wagon engineer, discoursing upon the cost of horse-keep and vehicle maintenance or figuring out the saving of labor-cost in the hauling of fertilizers by motor vehicles, might be met with a discouraging smile by that great majority of farmers who leave their agricultural machinery out in the rain and barely manage to keep themselves occupied in the winter. The more progressive tillers of the soil, however, also have their misgivings.

Mark Twain's experience as an editor of an agricultural journal may be studied with profit—mental, in this case—by some of the power wagon advocates who have dared to apply city reasoning to the subject of the agricultural motor. We are far from our moorings and deeply enmeshed in speculative reasoning when we attempt to make out a clear case in favor of machines which must necessarily remain idle for a large portion of the year, whose traction qualities must rise superior to almost any kind of surface conditions, even if speed and other matters must suffer, and which are expected to aid in doing many kinds of work totally different from that in which experience has been gained.

The subject does not lie close to the competence of those whose competence on power wagon economy is greatest in the more ordinary applications of motor power to transportation problems.

Data in regard to what has been done with motor ploughs, harrows, cultivators, spreaders, are unobtainable at present; and no doubt they would be obtainable if the results had been decisive. Under special conditions—on mammoth farms of smooth, stoneless prairie—the cable plough operated from portable engines stationed at opposite sides of fields, has given great temporary results. But how the economy has worked out, season after season, no one within reach knows. Besides, it is the self-contained, self-propelled machine in which the agriculturist, as a rule, is the most interested.

To sift the chaff from the wheat among information about agricultural motors which reaches this country weekly from Europe, is beyond the ability of the writer. From all sides the subject is hedged and the facts stated in terms leaving large loopholes of uncertainty in the mind of one knowing even only the rudimentary principles of agricultural work, though perhaps the same few, meager facts would suffice to convince those knowing either much more or somewhat less.

Nevertheless, spite of the doubts which must remain in regard to the specific economy of any vehicle or machine with motor power which may be built and offered for sale to farmers at this stage of developments—with a possible exception in favor of the motor mowing machine—it seems possible to predict with almost absolute theoretical certainty that the motor power principle will find its way into agriculture in exactly the same manner as it entered upon the solution of the much simpler daily routine transportation problems of commerce. Starting with sport and pleasure, mechanical perfection of the various types of power and transmission mechanisms was attained at the expense of pleasure seekers, or, here and there, at the cost of an unwary or theory-fond manufacturer. Physicians and inspectors thereafter embraced motoring, speed being highly valuable in their occupations. By slow degrees the commercial power wagon was developed, in all cases being accepted first in lines of business enjoying a high rate of profits, and, as experience was accumulated, it was gradually adopted for work more exacting in regard to the true intrinsic economy of the performance.

Agriculture offers a sure prospect of the same kind of successive adaptation to conditions. The market gardener close to the city is deeply interested in discharging his goods with the least possible waste of time. If he has large greenhouses, he will have goods to haul the year round. Dairy combinations already employ motor wagons for collecting milk and cream. Egg buyers do the same. The farmer's buggy is rapidly giving way to the motor runabout; soon his "spring wagon" will also find a self-propelled successor. Motors are being more and more extensively used on farms for pumping water and chopping feed; in some places for sawing wood and building stone. In brief, the minds of agriculturists are being familiarized with the thought of employing motive power for their personal transportation and for chores. The step to giving any motor driven field machine a serious trial is an easy one, and doubtless there will arise from their own ranks persons of the ingenuity required for rendering such machines thoroughly practical, if those which shall be offered them by designers and manufacturers prove faulty in some way.

It is not really the possibility of designing machines thoroughly capable of doing farm work which is in doubt, but only the question of their *economic* superiority over machines drawn by horses. The mechanics in the problem is merely a question of time and opportunity, while the economy comes nearer to being a matter of the principle of the thing.

Precisely at this point it has usually been overlooked that the speed superiority of the motor plough and motor cultivator often means very much more, economically, than saving of cheap human labor and cheaper horse feed. The number of acres taken under active cultivation each year depends in each locality very largely upon a surmise of how much acreage can be thoroughly attended to in a normal season. But as seasons vary, the estimate is made low, in order to obviate the heavy losses which occur if exceptional weather restricts the number of working days. Now, if the motor machine may be pressed into service, day and night if necessary, to "cultivate" the droughty corn fields or to plough a multitude of acres in the short spans of dry weather in an over-wet season, the total number of acres which the farmer may figure on as safe for his working capacity, may be immensely increased and his income will be increased in proportion.

In this one feature of the services to be expected of motor driven farm machinery lies apparently the fullest justification for inventors and manufacturers who may devote their efforts to this branch of automobilism.

XVII
Speed Checks Control Instruments

MOTOR vehicles bid fair to make this the age of popular engineering. The time was, when clocks, watches, thermometers and barometers were caviar to the public at large. Bicycles introduced another instrument, the cyclometer, to public consciousness and comprehension. Thousands became familiar with jigs, templets, gauges, calipers and micrometers through the bicycle. The little steam pleasure vehicles brought air and steam gauges and the frail water glass into the families.

The broad public are getting used to the employment of measuring instruments. *"Savoir, c'est mesurer"*—to know is to measure—declared a Swiss artist, who was also a scientist, in the beginning of last century, and the whole world finally begins to subscribe to his axiom and signifies its willingness to abide by instrumental records, rather than trusting to surmise as to what has taken place or admonition as to what is to be observed by others. It is more especially in money matters that recording instruments are preferred.

The power wagon belongs distinctly among money matters.

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It can eat up profits or add to them, accordingly as it is treated. It is not under its owner's eyes all the time. For days or weeks he does not see his inanimate but active machine-employe. A card system giving daily instrumental records of the power wagon's condition and its work, is therefore of the highest importance, and it is already introduced in the large installations, though probably in no instance as completely as it might be, and as it will be when the measuring spirit of the age reaches this department of human activities. Up to the present date attention has been focused on the apparently larger features in power wagon economy, but in proportion as all doubt of the reality of the economy gives way, the desire to *know* how and why it is realized or not realized in practice, and to what extent the possibilities for money-making are exhaustively utilized, is fast growing into an active demand for recording instruments of the right kind.

It is one of the primary advantages of the power wagon over the horse that it is wholly subject to exact instrumentary control.

Barn bosses, in order to exercise any authority over drivers and garage help, must be able to tell from the detachable leaf of a daily speed recording instrument, how far and how fast they have driven; not only their average speed but their speed at any given point of the route. Modern speed recorders enable him to do so.

Average speed means little when made up from two extremes. It is when rattling home with an empty wagon, making up for the time lost at the saloon, that the driver injures his charge. The speed recorder tells of the stop and the spurt, both.

The degree of care exercised in driving is subject to graphic record, though nothing has been done in this respect. Vibration and spring compression may be made to measure it. The movements of one spring would give an average for all. An instrument could undoubtedly be designed which would operate independently of the normal static compression of the spring under its load. The seismic recorders of the observatories, recently so busy recording the effects on the earth crust thousands of miles away from the volcanic eruptions of Vesuvius and of the Carribean Sea, might be simplified for use with power wagons to indicate the vibrations to which its parts are subject, either through any faulty construction or rough pavements or rough driving.

The manugraph, an instrument which gives an indicator card reading, telling at a glance the conditions within a gasoline motor cylinder, could easily be turned to commercial usefulness.

The simple instruments for grading gasoline and the electrolyte of storage batteries, are not yet in as general and frequent use as would be desirable. Yet, the owner of power wagons may easily insist upon seeing daily report cards of these readings.

Voltmeters and ammeters are usually employed in small sizes, roughly calibrated and subject to considerable deterioration from the use of indifferent magnets. Current indicators for ascertaining the condition of spark coils and for gauging their adjustment, are rarely seen in actual use. A more extensive demand for these instruments properly made, would result in cheapening them while also improving their quality.

The humble foot rule and the more pretentious calipers and micrometrical instruments have their place in the repair shops of power wagon installations, but could also find extensive employment in the hands of the drivers and the garage foreman for inspection purposes. To measure the sag of a spring, the wear of a bearing, the torsion of a frame, may often be the means of forestalling accident or repair, but, of course, it would be possible to go to an impracticable extreme in this direction. At present, the opposite extreme is easily touched.

XVIII
Traction Devices—Winter Wheels

NEARLY every city in this country has a multitude of unpaved streets which are transformed into morasses by rain or melting snow, and the majority of the country roads are soft, poorly graded and undrained. Not only are these street and road surfaces entirely subject to weather conditions, and frequently next to impassable, but the mud carried away from them on wagon wheels is distributed over the paved streets and macadamized roads, forming a greasy coating the more objectionable the smoother the paved street on which it is deposited.

American power wagons must cope with these conditions, unless their work is restricted to routes where the conditions do not exist. But the fact is that they exist so generally that only comparatively few concerns using power wagons can afford to disregard them.

These few concerns are principally located in New York City and some New England towns. Some hotels and summer resorts elsewhere may also be in position to rely upon hard roads all the time; these various concerns may therefore be justified in figuring on large sized, low-powered vehicles designed to produce economy mainly by high load capacity and without special traction devices or the manifold precautions which reliance upon high speed renders necessary. They are situated as the majority of power wagons in Europe, where similar road conditions prevail, but it seems worth noting that the drift in Europe is toward higher speed, even where speed is not compulsory for economy, and toward the use of rubber-tired wheels and special devices for better traction in muddy weather or snow, even where the necessity for traveling over poor roads is very infrequently presented. The rubber tire serves to secure higher speed and better traction, both, of course.

As a rule, the American power wagon owner, however, has no choice. Street and road conditions force him to reduce vehicle sizes, employ the highest practicable speed, and to look out for the question of traction at nearly all times of the year.

There would be no mention of speed and vehicle sizes in this article but for the fact that these features in power wagon economics are so closely mixed with the traction question, all three considerations being subject to road conditions, and also—all three of them—closely connected with the question of tires; tires sometimes determine the traction obtainable, always determine what speed is most economical (somewhat in conjunction with the matter of spring suspension), and, in turn, the types and sizes of tires are determined by vehicle weights and loads.

It would be difficult to point out anything more complicated in the whole sphere of power wagon employment than the interdependence existing between these various considerations. It offers a subject on which good common sense judgment has a chance for arriving at conclusions long before finespun deductions could be formulated by exact engineering methods—provided the common sense is aware of the interdependence referred to.

The two principal forms of failing traction are skidding and slipping. The skidding nearly always takes place where a firm surface is coated with a relatively thin slippery substance, while slipping is more common in deep mire. A hard icy surface or thoroughly drenched clay roads may produce both at the same time. The idle rotation of wheels in deep sand is somewhat different in principle, but all these phenomena are so well known and the remedies for them so much alike, that for brevity's sake they may be treated as one.

What is their influence upon power wagon economy, and what has been the experience with means for counteracting and obviating them?

If nothing at all is done for bettering traction in mud, snow, on greasy asphalt and ice-coated cobblestones, there are undoubtedly localities where certain desirable forms of power wagon service would be greatly curtailed by interruptions. Some owners of vehicles have preferred to take them temporarily out of commission rather than to adopt simple and inexpensive remedies for the trouble. The well-known tire chains, for either solid

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or pneumatic rubber tires, and steel studded bands for pneumatic tires, conquer probably 95 per cent of failing traction cases for all power wagons up to 3-ton load capacity. They are not pretty, and do not impress one as a definite solution of the trouble. But they save the day for the power wagon and its economy by keeping it going whenever and wherever horses can pull loads with something approximating ordinary transportation economy. If their value for 4, 5 and 6-ton trucks has not been up to the 95 per cent mark, it is solely because these vehicles, having a lower speed range, are, as a rule, relatively underpowered.

So far as American experience goes, there is little more to be said about the means for getting traction in the mire of unpaved streets and roads during the worst of a severe season. In deep snow the chains dig down to the firm bottom underneath, and, while many revolutions of the wheels, and consequently much power, are lost in the digging, the waste is probably no greater than with horses, except where sleighing is practicable. America has not by any means, however, exhausted the resources which are available. On British drays intended for country road traffic it is customary to have a device for locking the differential gear, and this is of course of great value in those somewhat rare instances when the traction is better for one driving wheel than for the other. It seems doubtful if the value pays for the complication. A much more practical expedient is the employment of larger wheels shod with sectional rubber block tires which take hold where a small wheel with a smooth tire would slip. Very few wheels more than 36 inches in diameter have been used in this country, and very few sectional rubber tires for general trucking. For special work special tires have been used, however. Where trucks are required to cross and recross railway tracks at all sorts of angles, wheels studded with short rubber cylinders held on by massive bolts and washers, so as to make the projecting boltheads take the brunt of the wear and tear, have been used with signal economy. Tires with scolloped edges are employed on several Chicago vehicles, but as these tires have practically no resiliency, and data in regard to their true economy (considering protection of machinery an essential) are lacking, the mere mention must suffice.

Just as it is accepted that commercial trucks and delivery wagons should not be required to cross unbridged streams, there are of course other exceptional conditions under which their power would be exerted in vain. If it paid to meet such conditions, they could be met, as when military vehicles are equipped with windlass and rope for hauling themselves out of streams and ravines. But in commerce the problem is not that of overcoming the extraordinary, but of giving an average all-the-year-round service at a minimum of expense, and so far as failing traction is concerned, the whole question is that of reducing troubles from this source to an insignificant minimum.

With the right sizes and powers of vehicles—selecting each for the work it must do—this is already accomplished, though further improvements in the way of special winter wheels may perhaps be expected. The special winter wheel, or mud wheel or sand wheel, which may be desirable under certain, rather unusual, severe natural conditions, would naturally embody all the traction qualities obtained by the use of chains or block tires, in some more permanent form. Where they may be required for obviating all interruption of work, their value would of course be measurable in the total additional amount of work which they would permit, plus the not inconsiderable item of the saving of ordinary wheels and tires which otherwise would be employed, at least for a part of the time, under uncommonly trying conditions.

Among special expedients, not ordinarily used, but yet available, for reducing failing traction to a minimum when the devices already mentioned might prove insufficient, a number may be briefly referred to.

Load distribution means a good deal. With steel tires, it is British and continental experience that two-thirds of the vehicle weight and load *must* rest on the driving wheels in order to secure traction on icy surfaces and slippery hard pavements. With rubber the proportion need not be so great, but the greater it is the less the liability to either side-skidding or rotary slip. Careful load distribution under specially difficult conditions may therefore be recommended as the very cheapest method for minimizing trouble.

Platform springs, particularly in the rear, will serve to equalize the weight distribution between the two driving wheels, and will therefore help to the same end. And the same holds true of any other construction feature permitting the wheels to readily follow inequalities of the road surface.

If the front wheels are driven, side-slip is seldom experienced, but the bulk of the weight must in that case be over the front wheels, of course, whether they are also steered or the steering is done by the rear wheels.

By driving all four wheels, side-slip is obviated to the same extent, and in addition it is made easier to avoid idle rotation of the wheels; from the fact that one of them cannot be made to slip unless all of them slip.

Wood tires do not seem to be of special value for securing traction and are available only for vehicles with four-wheel drive, because they wear flat if subject to slippage. Their lack of resiliency, as compared with rubber tires, seems to limit their province further to slow-speed vehicles operated on smooth or soft roads.

XIX

Apprentices in Shops and Stables

DURING the past year it looked as if there might be need of taking special action for securing competent helpers for the garages of power wagon owners. There was an apparent scarcity of young men with an appreciation of strict business requirements in motor vehicle matters. The leathered chauffeur of the pleasure automobile showed little inclination for entering upon duties of a commercial character in combination with the driving of gasoline trucks or delivery wagons, and the electric truck business grew so rapidly that good caretakers for electric vehicles easily found employment in the public garages and the repair depots of storage battery makers. The supply of drivers for electric vehicles at no time gave much cause for apprehension of a shortage, as it was practicable to train almost any teamster or clerk to do the work satisfactorily.

For a while it was a matter for discussion in several mercantile houses in New York, whether it would be practicable to switch young clerks and boys into the private garage to teach them the care of electric vehicles at nominal pay and hold them after they had learned the work, as drivers and caretakers combined. Manufacturers of gasoline vehicles were in a couple, or possibly more, instances requested to supply young men from their shops. The idea seemed to border upon a plan for waking up the young men of this country who might be looking around for a suitable avocation, to a realization of the fact, that the use of motor vehicles in business presented—and still presents—an opening for the formation of an entirely new trade involving the combination of a certain amount of mechanical insight and skill with the ability to drive and certain commercial qualifications, such as soliciting orders and keeping tab on vehicle expenses.

That a trade of this description is awaiting development seems beyond question, but in the course of events it was shown that the development would come about through the channel of public motor vehicle schools rather than by private initiative.

Motoring schools have increased in number and in the quality of their course of instruction, of late, and bid fair to supply before long an army of young men who will be prepared to assume regular duties in the driving and care of motor vehicles expected to be operated for profit and with a minimum of expense.

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XX

Accounts and Their Keeping

CERTAIN advantages of power wagon transportation elude almost any bookkeeping system that may be devised, but these advantages are on the other hand so conspicuous to the commercial mind that frequently the realization of them has caused the adoption of power wagons by firms who were fully convinced that their use would prove more expensive than their previous horse-and-wagon equipment had been. Being satisfied of the extreme value of the special business advantages of quick, long distance hauls, such firms made no preparations for keeping expenses down, and the discovery that the whole power wagon plant could be operated at lower total cost than the horse-and-wagon plant—when this discovery in a number of cases was finally made—came to them as a surprise.

One of the principal ones among the advantages referred to was recently admirably expressed in the following words: "The advent of the power wagon is most opportune. All great cities, by the aid of the electric trolley lines, are extending into the suburbs in such rapidly enlarging circles that a serious question is raised as to how merchandise may be transported from the market to the home. The motor wagon solves this problem and is already to a considerable extent the general utility wagon under the new conditions in the commercial world, *extending the bounds of the tradesman's field and bringing what had threatened to become unprofitable areas within the zone of his enterprise.*"

So long as the merchant saw that the power wagon exerted a direct and powerful influence to enlarge his volume of business, he was satisfied that he would continue to use such a valuable agent, whether its salary was high or low. In fact he took it for granted, that such services must come high, and he made no effort to ascertain just how high. Knowing that the expense account would not shake his determination to continue their use, he was not interested in perfecting the bookkeeping system. Then, gradually, it was brought home to him that one power wagon cost much more to operate than another, for some as yet inscrutable reason. One was delightfully economical, another in similar service ran up big repair bills and was constantly out of commission. There must be a reason! It was worth looking into. And quite a few did look into the matter and finally made the pleasing discovery, as already mentioned, that the total cost of the whole power wagon service depended chiefly upon careful attention to details and could be reduced to figures which spelled a clear gift of all the special advantages for which they had been willing to pay a high price.

In each concern, interest in system and exact bookkeeping began with this discovery. Before, the bookkeeping had been purely perfunctory. It took account of battery repairs, tires, gasoline, lubricating oil, overhaulings of gasoline vehicles, painting; and failed to give the least information about wages, mileage, days in commission, hours at work, depreciation, etc. The wage account, particularly, was mixed with all other wage accounts of the same firm and, where horses were also used, expenses applying to the horse equipment were hopelessly confused with those of the power wagon installation.

In many cases no special accounts were kept at all, because the vehicles were operated under a maintenance contract by which the makers and sellers undertook to deliver the trucks—always electric trucks, under these circumstances—in working order at the owner's loading platform every morning for a certain stipulated sum per month. This arrangement gave the owner all the benefits of the labor-saving and commercial advantages derived from power wagons, at a fixed price, and threw the risks incurred by over-loading and reckless driving upon the makers. The system was employed to quicken sales, but gave cause for many disputes and delayed the wagon owner's arrival at rational methods for operation, maintenance and accounting.

The value of an account system lies, of course, in its tendency to pointing out faults in investment, utilization, operation and maintenance to those who commit the faults and suffer from them, thereby leading to their correction. Under the maintenance contract plan there was little use of keeping track of things and the responsibilities were split.

Under the circumstances here briefly outlined, it is not surprising that no efficient account system for power wagon installations has reached publicity as yet. Several concerns are known to have developed systems satisfactory to themselves and very nearly complete so far as the mere recording of expenses is concerned, and embodying also card records of repairs and regular garage work, such as battery charging, washing and cell replacements, but the writer has not yet been privileged to see any system—neither for gasoline vehicles nor for electrics, let alone for both combined—by which an owner would be enabled to tell readily whether the utilization of the vehicles exhausted their working capacity; whether the operation of any one vehicle, or all of them, was judicious; whether the maintenance of any one or all vehicles was conducted with a view to complete utilization of its earning capacity, and what relations the maintenance cost in any or all cases sustained to the methods of operation and utilization.

In all instances which have come to notice the allowance for depreciation has been so large as to suggest that the possibility of eliminating depreciation account completely by a very thorough maintenance system has not yet occurred to power wagon owners, although depreciation, as at present considered, is a factor of so much uncertainty, that its recognition in an account system is disturbing rather than enlightening. While depreciation may appear to be a factor requiring consideration so far as each vehicle is concerned, it is not necessarily a factor in an installation of many vehicles, and it may be safely contended, that the maintenance system in an installation will not reach its best development, before depreciation of the installation, as a whole, and of each vehicle to a much greater degree that at present, is eliminated. So far as accounting is concerned, it should be possible to do this to such an extent, that all new entries on investment account will correspond to an increase in the volume of work to be done by the plant.

XXI

Steam Vehicles, Now and Later

WHY are steam business vehicles scarce in this country, while numerous in England and France for the heaviest work? Is there no possibility of employing them to advantage? The answer is not altogether flattering. They are scarce, mainly because automobile manufacturers, with practically only two exceptions, dropped steam pleasure vehicle production, and the two exceptions have been so busy satisfying the demand for their special types of steam pleasure vehicles that production in the business vehicle field offered them no inducement.

The abandonment of steam was a matter of yielding to popular clamor, rather than the result of a reasoned conviction. Steam still has advantages as well as disadvantages. There is no room for discussing either in this article, but it may be said that the preponderance of evidence tends to show that for average conditions of commercial work the gasoline motor vehicle is preferable, while, on the other hand, there are large branches of work for which the electric vehicle is most suitable and, again, special

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conditions for which the steam vehicle is much more suitable than either of the other types. How large a field these special conditions represent, remains to be seen. In the aggregate it is probably very large. Compared to the field for gasoline and electric vehicles, combined, it may properly be estimated as small.

So far the American motor vehicle industry has adapted itself to average conditions rather than splitting its energies. The steam dray is therefore lagging behind, but it is not lost. The public may call it into life at any time by demanding it. Already a few steam engineering companies are nursing the demand under the disadvantages which are inseparable from any attempt at breasting the popular trend.

XXII

The Sociological Side

ANY inflence so widespread and deep as that exerted by the motor vehicle movement, in general, and the use of motor vehicles in commercial work, in particular, must necessarily affect the whole social fabric and the external forms of civilization. The changes already in process are highly interesting and will, in course of time, mean very much for enhancing the advantages of employing power wagons. They will reduce the cost and increase the convenience of local transportation beyond anything dreamed of at present, but these advantages will by that time be at the disposal of all. As a lever in commercial competition they will mean very much less than the half-developed advantages of power wagons mean today.

Commercially speaking, the power wagon is now at its zenith. Economy is established; pioneering is past. There will never be a time, when the adoption of power wagons for business work will contribute so strongly to business success, as it may be made to do now.

In business absolute economy means nothing; relative economy everything.

* * * *

The individual owner of power wagons can do little toward either advancing or retarding the broad sociological effects of the motor vehicle movement, out of which he snatches a personal success. They are produced by the spread of the movement, but can take no place in his plans. They may therefore be dealt with here with extreme brevity, being purely of ordinary human interest, until the time comes for taking advantage of them.

In the first line among these developments comes perhaps the relief of street congestion which the general use of motor vehicles for all purposes must in the end afford. Occupying one-half the space of horse-drawn vehicles and going twice as fast, motor vehicles release three-fourths of the street area. This effect is already being felt to some extent. The same is true of the tendency of the motor vehicle to encourage country or suburban residence. For possibly improving the moral complexion of the community the eventual effect of this tendency should be one so strong as to be replete with interest for the student of sociology, and hand and hand herewith there is the cause of good roads and pavements which is undoubtedly receiving great encouragement from most users of motor vehicles, the latter being in a position to measure the value of reliable roads in a saving of both time and money.

One somewhat underrated effect is the wonderful advance in popular mechanical insight which follows the employment of motor vehicles everywhere. Remembering that every step of progress in civilization has been signaled by one invention or another, there can be but little doubt that the participation of the people in general in mechanical intelligence will result in a marvelous addition to the number of those who will add their quotum to civilization, rather than being mere followers.

The industrialization of agriculture may be mentioned last, though perhaps it will prove the most important of all the ramifications from power wagon use. The thorough emancipation of "the man with the hoe" seems to be distinctly foreshadowed in the rapid introduction of "small power" in all kinds of agricultural work; and the convenient little engines, whether portable or stationary, owe their development to the motor vehicle movement.

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Municipal Ownership

Financial Role of Motor Omnibuses When City Assumes Operation of Public Transportation

WHATEVER may be thought of the feasibility of administering public utilities under municipal ownership, state ownership or national ownership, it is evident that steps toward the realization of such public ownership and administration may be taken with more or less intelligence, more or less efficacy and more or less profit or loss to the public, individually and collectively. It is in fact the principal objection to the municipal ownership idea that experience of the past gives little hope of bringing so much intelligence and integrity to bear upon the management of public utilities as are required in the management of any vast business organization. It is also evident that the public ownership movement is one of those realities which business men must recognize as a force, whether they approve of it or not. Where it is sustained by a majority vote, its principles will be embodied in business operations of some kind and of considerable magnitude sooner or later.

A citizen in a community where definite propositions are on foot for having the public take over the transportation work now done by street railway companies, is interested, as a citizen and taxpayer, in having the change made in the most efficacious and least costly manner. As an individual, he has furthermore the right to ask himself the question: "How can I personally make money out of *that?*"

In the case here under consideration it is perhaps mostly the members of the motor vehicle industry who have reason to ask, how they may turn the municipal ownership movement to good account in their business, and as it happens that their interests in the matter are identical with those of citizens in general, save only the present owners of street railway properties, they may be congratulated to the exceptionally fortunate combination of circumstances which confronts them wherever the municipal ownership idea has found strong popular support.

Since Mayor Dunne of Chicago threatened to bring the street railway franchise holders of that city to terms by placing municipal motor omnibuses in the field against them, more than one year has elapsed, and during this period the motor omnibus has proved its worth in London, Berlin and Paris. What was a fanciful anticipation of problematic possibilities when Chicago's mayor uttered the word, has become acknowledged by some of the keenest financiers of four metropoles as a magnificently sound business opportunity, entirely apart from such extraordinary special inducements as the situation offers the city of Chicago for assuming the organization of motor omnibus traffic.

If the opportunity is not embraced by Chicago, the failure to do so will go very far to prove that municipal ownership *is* a fallacy; that a city cannot meet a business situation with quick, decisive action appropriate to the special nature of the situation, but must needs act slowly and according to the low average intelligence of its composite personality.

Chicago proposes to assume a new bonded debt of 75 million dollars, in order to be able to redeem street railway franchises which her aldermen gave away in years gone by.

The purchase and operation of one thousand motor omnibuses would permit the city to reduce this sum to about 10 million dollars—a saving of 65 million dollars—and to give her inhabitants in the bargain the most complete and convenient transportation system of any city in the world.

The street railway companies would continue to operate until their diminished earnings compelled them to reduce their watered stock or to surrender or forfeit their franchises, in either case placing their equipment at the city's disposal at figures assuring large profits even under an indifferent public administration. And the simultaneous operation of motor buses would quickly demonstrate by the trend of the patronage where the rail lines should be continued and where they should be abandoned.

Some motor omnibuses, double-deckers, in London and Paris carry as many as 60 passengers, but most of

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the London buses do not exceed 34 pasengers. Let it be supposed that the bad pavements and the different habits of the population of Chicago would reduce the maximum carrying capacity to 30 for each bus, though in the summer open omnibuses with cross-seats and room for 20 on the roof could easily carry more on some of the routes. With an average of 20 minutes' ride for each passenger, which would be equivalent to 3 to 5 miles, and the buses working 16 hours per day, with two shifts of men, the maximum gross receipts per day for each vehicle would be 1,440 fares, or, at 5 cents per fare, $72. Though the extreme elasticity of a motor bus system would permit an arrangement of routes adapted to draw a maximum of traffic to each bus at all times of the day and evening, it would perhaps not be safe to depend on more than one-fourth of the maximum or an average load of 7½ passengers, one hour with another. The gross receipts under this moderate supposition would amount to $18 per day per vehicle; $18,000 per day for all of the 1,000 buses, the purchase price of which would be about 5 million dollars. The gross receipts in one year would be $6,570,000. By that much the receipts of the street railway companies would be reduced, and as the sum named represents 8¾ per cent per annum of the 75 million dollar capitalization of these companies, there would be no profit left upon their stock. And as its value is solely depending upon its earning capacity, its value would be reduced to nothing.

This is a diagrammatic view. In reality, the city could not purchase 1,000 motor omnibuses in less than three years' time. The industry could not produce them. And, moreover, the city would not want to plunge into too many uncertainties of construction, organization and operation. From a financial standpoint, as well as from every other rational viewpoint, deliberate methods would be all the better. The investment in motor omnibuses would not need to exceed the amount of annual interest upon the proposed bonded debt of 75 million dollars. And watered stock is peculiarly sensitive. The mere starting of a motor omnibus system by the city—with one hundred vehicles for example—provided the gradual extension of the system were authorized and all thought of purchasing the street car systems at their own valuation were laid *ad acta,* would have a magic effect. The psychological moment would soon arrive when the financially inclined minds of the western metropolis would be able to figure out a nice equilibrium between the reduced street railway values and the cost of extending the bus system, between the relatively low cost of street railway operation and the superior advantages on many routes of the fleet and independent power omnibuses.

It would be a hard blow to all confidence in the ability of municipalities to enter upon large business enterprises, in the interest of the public, if events should prove that Chicago must cast away a certain economy of 60 to 70 million dollars for her citizens at large, for the sake of protecting the vested interests of the few innocents who have bought watered street railway securities through foolish faith in the permanence of their inflated value. Individual business men or managers of business corporations cannot afford similar considerations and do not indulge in them. If "municipal ownership" must do so; if it must pay out 70 million dollars belonging to those who trust it to guard their property, when a business situation exists permitting to escape that vast expenditure—then "municipal ownership" is doomed as an article of American political creed.

There is, of course, an opposite view of the case. To avoid the accusation of partisan argument in favor of the motor vehicle industry, it may be stated.

Borrowing 75 million dollars and paying out the same sum, the city of Chicago gets in return street railway properties of a demonstrated earning capacity sufficient to pay the interest on the debt and, in addition, an annual amount which, applied to a sinking fund, will wipe out the debt in a given number of years, while permitting also the maintenance of the property. The city, then, is out nothing. An investment of 5 million dollars, or any other sum, in motor omnibuses, is a venture. The buses may *not* earn enough to pay for their operation, maintenance and depreciation. The city, in that eventuality, would lose money.

In this statement the large elements of risk are left out of consideration, which are involved in the purchase of street railway property which is commonly admitted to be in bad condition—roadbeds in need of radical repairs and rolling stock shrieking for replacement. But that is a matter of detail. However vital to the question of economy and soundness of the investment, it may be passed.

What is fundamental is that the earning capacity of a motor omnibus system *has* been demonstrated to be sufficient to satisfy individual investors, maintenance and depreciation duly considered, and, while not at present quite as profitable as the most economical street railway systems, capitalized according to the real investment, it is much more profitable than a street railway property purchased at a valuation based on its highest earning capacity. It may be mismanaged, but the losses incurred in that case are decidedly smaller and much more readily subject to control and correction than losses due to bad street railway management.

Gradual adoption of motor omnibuses takes care of the risk element. With street railway properties gradual assumption of the new municipal activities is out of the question, at least in the case under discussion.

If a city shall not be considered competent to employ the same kind of judgment, based upon experience in other comparable cities, as a conservative business corporation would employ, municipal ownership advocates must admit a fatal handicap for their theory. In the present instance, however, no reliance upon difficult or expert business judgment is required.

Where street railway properties must be bought by a city, rather than established at true prime cost, all judgment as to risk in establishing motor omnibus service is entirely relieved of uncertainty by the fact, referred to above, that it is the gross earnings, which are practically beyond all doubt, and not the net earnings, by which the real financial coup is accomplished, viz., the reduction of the street railway property valuation.

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Solid Rubber Tires

Synopsis of Qualities Sought and Construction Methods Followed by American Makers

GRADUALLY, as all tires are improved, the owner of power wagons may find it more important to select the right sizes and shapes of tires for his vehicles than to make a distinction as to where and by what tire manufacturing concern they are made. The best tire may be destroyed or worn out in three months, while one not the best may last eighteen months in service not necessarily more severe. A reckless driver may needlessly destroy a value in tires equal to the amount of his wages, and obliterate all the difference in intrinsic and average value existing between two lines of manufacture. If, in addition, a vehicle is habitually overloaded and the street or road conditions are unfavorable, and if finally the sizes of tires and wheels and the flexibility of vehicle springs are not somewhat in accordance with the work to be done, it would be like the straining of gnats and swallowing of camels to be over-particular about the line of manufacture and the principles followed in each of them.

Under average conditions of intelligent use, however, it is manifest from the rapid succession of improvements in tire construction and from the manner in which one make of tires gains popularity for heavy work and another for lighter work, that the principles involved in tire making present questions of economical interest to power wagon users, and in many cases questions which he alone can answer who is intimately acquainted with the work and the road conditions. In many forms of business, for example, where despatch is of greater moment than absolute dependability, pneumatic tires may undoubtedly be used with all-around economy. In the following, however, only solid rubber tires are considered.

So as to enable power wagon users to consider the requirements in solid tires in relation to their business requirements, and with a view to stimulating reflection on the whole subject among the users of power vehicles, there are presented, herewith, the answers received from all rubber tire makers in this country to a request for authentic information on the following points:

(1) What is the active principle of your method of construction, including the reason therefor?

(2) The weight of wagons to which your tires may be fitted?

(3) The sizes of solid tires you manufacture?

(4) The possible variations in construction to correspond with variations in vehicle sizes and loads?

(5) The life of your tires in normal service on vehicles of given weight with given loads at given speeds over normal conditions of road surface?

(6) The cost of re-shaping any given size of tire, and estimate upon the extended service which may be obtained from it?

(7) How close to the rim you recommend the wearing of solid tires on power wagons of any given weight and load carrying capacity?

Diamond Co.'s Truck Tires

The Diamond Rubber Co. of Akron, O., sends information of its Wire Mesh Base Tires, substantially as follows:

"In the case of the motor truck tire, the problem is to furnish something which will reliably transmit considerable power, carry heavy weights without injury to the roadbed, absorb noise, prevent loss of traction and slipping and by moderating a considerable proportion of shock and vibration, prevent crystallization of the metal in the frame and power plant; all at the lowest possible cost per ton mile.

"A truck tire consists essentially of at least three parts. It must have a tread or wearing portion; it must have a base which rests on the rim; and it must have somewhere about it means of maintaining this base in a fixed position on the rim. This is accomplished in buggy tires by the use of internal wires and cross wires of various types, but these devices when called upon to carry heavy weights, to transmit power and to stand the terrific strains of sudden starts and more sudden application of brakes, have proven unsuitable.

"In all such devices it has been the universal experience that the motion of the rubber about the imbedded fastening devices has rapidly set up a chafing which accelerates as it progresses until the tread or wearing portion is entirely cut away, leaving exposed the retaining device and the base, still retained.

"Since it is apparent that any movement of rubber about the attaching device is destructive, it follows easily that the attaching device should be placed under conditions that prevent chafing. For that reason the base of the Wire Mesh is rigid,—there is absolutely no motion in the base of the tire; and in this tire, for economy's sake, the base of the tire is the entire attaching device. The base consists of one long strip of strong wire mesh wound about a drum, until three or four layers, as may be needed, are completed. The unvulcanized rubber is then placed in position and forced through the meshes of the wire fabric and then vulcanized into place.

"The rubber by itself is tough and firm, but slightly yielding in the tread portion. At the base, however, it constitutes, in connection with the wire fabric, absolute rigidity. The tread, therefore, is actually interlocked into the base clear to the felloe and the rigidity of the base, which is also the attaching system, is such that chafing cannot occur.

"The tire and attaching device is practically complete

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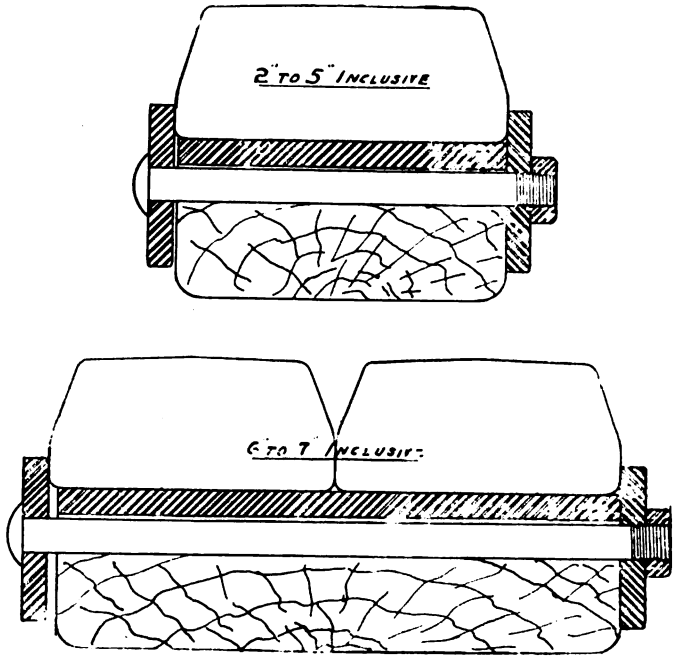
in itself. Its rigidity makes creeping impossible, since the entire tire would have to move circumferentially at the same instant, whereas creeping occurs in tires with soft bases and is a progressive movement, like that of a common angleworm. The only purpose of the flange is to prevent the tire from slipping sidewise off the felloe. No staybolts of any kind are employed.

"The greater the initial cost of the tire, the higher must be the mileage obtained to attain a certain cost per ton mile. The tread of the tire must deliver this mileage, since that portion of the tire below the rim can never come in contact with the ground and cannot deliver mileage.

"If, for example, in one tire a tread is employed capable of delivering twenty-five thousand ton miles and



DIAGRAMS OF DIAMOND WIRE-MESH BASE SINGLE AND TWIN TIRES

this is attached to a base one inch thick, such a tire will produce a lower ton mile cost than one with a similar tread attached to a base two inches thick, assuming the materials to be of the same cost per unit of volume.

"The base and tread of the tire may well be compared to the operating cost of a factory, the base representing the non-productive expense, and the tread the productive. It is therefore necessary in order to produce the greatest economy to balance carefully the relative volume and cost of the base and tread. The tread should be limited in bulk and initial cost to the ability of the attaching system to hold the tread in place successfully until worn out. It is false economy to build up a tread so high that only half of it can be turned into mileage before the attaching system lets go.

"On the other hand it is wasteful to employ a bulky, expensive base with a tread capable for any reason of developing only a low mileage. An examination of the Wire Mesh Base system will quickly show a careful balance of these points, only seven-sixteenths of an inch in the large sizes is beneath the top of the side flanges. The base of the tire has been broadened materially and a substantial, broad, flat tread of large area employed.

"In the case of the old buggy tire shape, with its round narrow tread, the tire is forced to flatten under load. This requires power. It isn't easy to flatten out a five inch tire. A tire is not by any means perfectly elastic, therefore, when it comes back into the round shape all of the power is not returned. There is, therefore, a considerable waste of power, and, moreover, it is exactly this constant flattening and springing back into normal that weakens the rubber.

"In the Wire Mesh Base Tire it has been the aim to develop a construction which would permit repairs or replacements without the expense and delay of removing the wheel and sending it to the manufacturer. If a nut or bolt is sheared, the tire may be safely used until convenient to put in a new one. These nuts and bolts are standard and may be obtained at any hardware store for a few pennies. It is only a matter of two minutes to replace one. Under no conditions is it possible for a tire to come off or for any accident to happen (by the breaking of a wire or bolt) which can make it impossible to go home on the tire.

"An extra tire may be carried in stock by the owner of a truck and in case of injury requiring a vulcanized repair at the factory, the extra tire may be put on in half an hour without even taking the wheel off the truck and by ordinary unskilled labor. The flanges are all drilled to standard templates and are absolutely interchangeable. An injury to the flange, either bending it inward or outward, will not harm the tire nor interfere with its successful operation.

"The rubber compound now in use has been developed by test under exaggerated loads and varying speeds. It is sufficiently firm to resist destructive distortion at the point of contact with the pavement, but still retains a remarkable resistance to wear and has no tendency to chip. It is vulcanized by a process which insures even and perfect vulcanization clear to the center. Care has also been taken to provide a compound adapted to give good results with vulcanized repairs.

"It has been evident for some time that the use of a single tire in sizes above five inch is bad practice. The starting, stopping and side strains cannot be evenly distributed over the base of a tire above five inch. There is no limit to the extent to which twinning and tripling in six, seven and eight inch widths may be carried in Diamond Wire Mesh Base tires. It is perfectly practical to mount *any number* of these tires of *any size,* side by side and only one pair of side flanges is required.

"No especial skill is required to apply these twins. The tires are easily driven into place with a mallet and it only remains to tighten a dozen nuts.

"The advantage of the twin tire over the large single tire is tremendous. The distribution of working strains is as perfect as in the smaller sizes, and therefore the ton mile cost is reduced.

"In case of accident, generally only one tire is injured. It has been found also that the traction is very

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much better on slippery roads, and the tendency to skid is practically eliminated."

The Goodyear Construction

The Goodyear Tire & Rubber Co. of Akron, O., covers the query by sending its special folder on motor truck tires, from which the following explanation is copied:

"When you buy a rubber tire, you buy it for its wearing and cushioning qualities. The more cushion it imparts, the greater value you receive for your money, provided it also wears satisfactorily. That is because the greater the cushioning qualities of a tire, the better shock-absorber it is, and it is the saving of your vehicle and its mechanism against road shocks that lengthens its life and saves maintenance expenses.

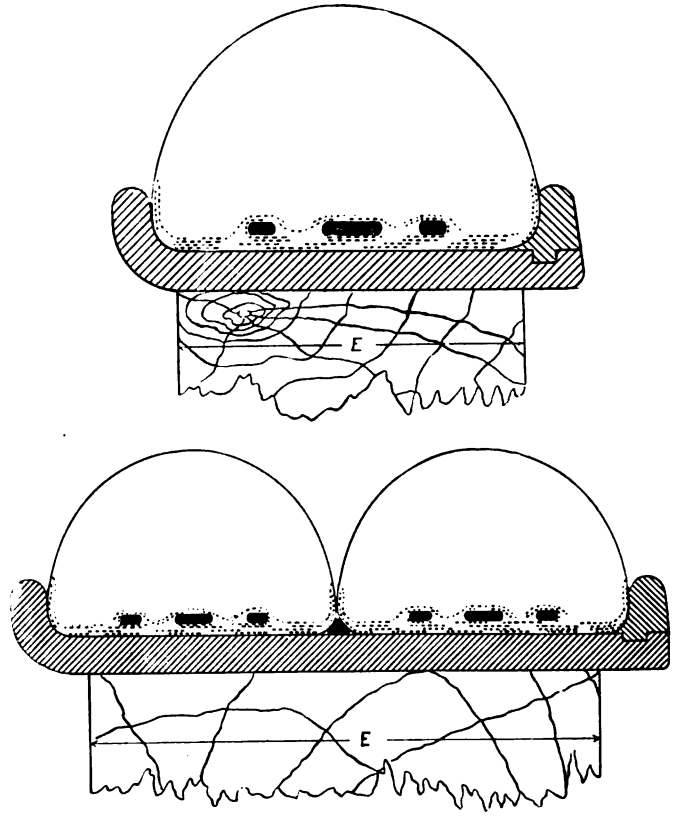
"The Goodyear motor truck tire is a great absorber of shocks, for three reasons;—first, that there is an abundance of live rubber above the channel edges; second, because the fastenings of the tire are located in the extreme base of the rubber; and, third, because it is made of extremely lively rubber. To explain more fully: Metal fastenings extending through the full width of the tire deaden all action of the rubber below such fastenings, consequently destroying that portion of the tire's value as a cushion or buffer. That is why Goodyear fastening is kept in the extreme base of the tire—to leave as much live rubber as possible.

"High side flanges that grip the base of the tire like a vise, deaden all the 'give' or cushion of the rubber below the gripping line, leaving only about one-half of the tire free to act as a cushion. That is why we have avoided high, vise-like flanges in the Goodyear construction.

"The accompanying drawing shows that only a small portion of the Goodyear motor truck tire is occupied by the metal band fastening. This leaves nearly all of the rubber to act as a cushion; or—to be exact—not more than one-tenth of the Goodyear motor truck tire is taken up by the fastening, leaving nine-tenths to perform its cushioning functions, whereas in most motor truck tires practically one-third to one-half is taken up by the fastening, leaving only two-thirds to one-half free to perform its cushioning functions. In these 'half dead' tires the purchaser pays a big price for a lot of rubber that does no good.

"The very fact that our tire contains so much rubber not deadened by flanges or other fastenings is one reason that makes it last so long. Instead of being pounded to pieces in a short time (as a half-dead tire would be), each shock is so easily absorbed and disposed of that it takes a long time to finally affect it. Besides, the new lively rubber of which it is made, is toughened to resist wear.

"Here's the other reason: Metal embedded in rubber will begin to cut away from the rubber just as soon as the combination is subjected to motion. The tread of a tire gets the most churning or motion, the base the least, or practically none. The lower down a metal fastening is placed in a tire, therefore, the less danger there is of cutting. All tire makers strive to get their fastening as far away from the tread as possible. In other words, as near the base of the tire as the particular construction of their fastening will permit. But most of them don't permit getting very near. The Goodyear perforated-band fastening, being flat, can be placed so near the base that it is practically out of the zone of motion, altogether. Getting no motion, it does not cut away the rubber, and, consequently, outlasts all fastenings that do.



SINGLE AND TWIN TIRES AS MADE BY GOODYEAR COMPANY

Another advantage of our construction is that when a vehicle is not in use, the load can be taken off the tires, by propping the vehicle on the wide and strong flanges of the channel."

Hartford Co.'s Turner Tires

The Hartford Rubber Works Co. of Hartford, Conn., give information in regard to Turner motor vehicle tires, with reference to the points of inquiry enumerated in the beginning of this article substantially as follows:

"1. The Turner endless solid tire is molded so that the inside periphery of the tire is slightly smaller than the outside periphery of the wheel itself. After the tire and wheel have been shellacked, the tire is forced on the wheel by hydraulic pressure, and by referring to the cut you will note that there is a cushion of rubber between the inside internal longitudinal wires. By reason of the tire being slightly smaller than the wheel, there is a pressure created against these wires, which effectually prevents the tire from moving on the wheel. In addition to the above, there is a compression of the side flanges aganist the edge of the tire when bolted to the wheel. In the six years during which we have manufactured this

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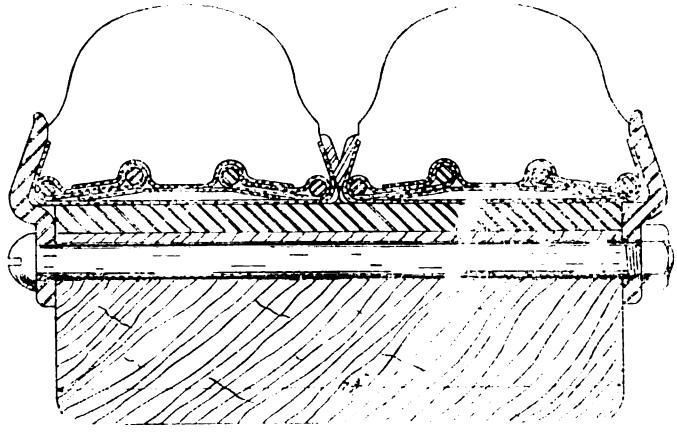
tire, we have had no trouble with creeping, nor have we found any defect in the fastening device. Not only is the tire held firmly to the wheel by the method of application, but there is absolutely no opportunity for any deterioration of the fastening device by reason of water getting to it and thereby rusting out the wires.

"2. The Turner endless solid tire is made in sizes to carry loads varying from 1,000 to 20,000 pounds.

"3. The Turner endless solid tire is manufactured in sizes from 2½ inches to 8 inches in sectional diameter and for diameters of wheels varying from 28 to 60 inches.

"4. The Turner tire may be equipped to the wheel in single form to carry a maximum load of 10,000 pounds. There is an exception to this, however; for we have in successful operation single tires carrying a maximum weight of 20,000 pounds, but we are recommending the use of the twin tire on all those in excess of 10,000 pounds.

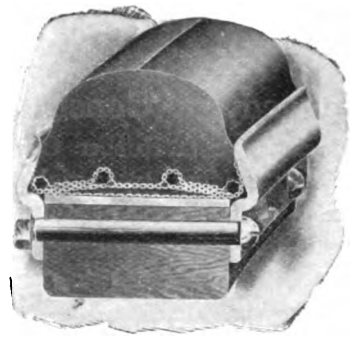
"5. We cannot give definite figures as regards the life of the tires for the simple reason that conditions vary to such an extent that it would necessitate making specific illustrations on about every vehicle that is manufactured. In general, we can say that for the last six years we have furnished tires to carry different loads, and under different conditions they have been considered by



TURNER TWIN TIRE FOR TRUCKS BY HARTFORD COMPANY

people operating commercial trucks as entirely satisfactory when it came to the question of the cost of tire maintenance. The fact that we are doing a tremendous business on a tire which we have made for a period covering six years, we consider ample evidence of the fact that vehicles equipped with Turner endless solid tires, in accordance with our recommendations as to size of tire to be used for certain loads, can be operated at a cost that is not excessive as far as tires are concerned.

"6. It is a difficult matter to give any fixed schedule covering charges for repairing tires. Each case has to be treated individually and, of course, you appreciate that it depends entirely upon the amount of rubber required to make the repair and the necessary labor in connection therewith. Roughly speaking, the average repair can be made for about one-third of the cost of the tire to the customer, and in the average instance would prolong the life of the tire, at least, one-half, although this as you may well understand will be subject to considerable variations.



SINGLE TURNER TIRE BY HARTFORD COMPANY

"7. We do not object to the Turner endless solid tire being worn down until the flanges come in contact with the road surface. You will readily understand, however, that the continuous bumping of the flange would injure it.

"Our catalogue gives a brief description of the tire, list prices, all data necessary for building wheels to take the tires, and the weight to be carried on certain sizes of tires, as well as the mold equipment which we have at the present time of writing. If necessity demands, we can, of course, build any size tire on which we quote prices."

The Swinehart Construction

The Swinehart Clincher Tire & Rubber Co. offers the following reply on the seven points enumerated above:

1. The active principle of construction employed in the manufacture of Swinehart Tires is to *hold a clincher tire to a standard clincher rim intended for a pneumatic tire by means of cross wires placed at intervals of one inch from center to center.*

The outer ends of these cross wires engage underneath the inturned edges of a clincher rim. The inner ends which just pass the center of the tire and incidentally pass each other are held in place by a longitudinal wire over the inner ends of the cross wires. The center groove or cavity in the base of the tire where the longitudinal wire is placed is afterwards filled with a hot gutta percha cement in order to make a perfectly solid base, and also in order to prevent the tire from creeping in the rim.

The reasons for constructing a tire of this sort are: (*a*) That owing to the large number of standard clincher rims which are at present equipped to automobile wheels, it is advisable to furnish a tire which will fit the majority of rims without having to change the wheels; (*b*) the weight of a standard clincher rim is considerably less than that of an ordinary solid tire channel; therefore, it is considerable better adapted for use on automobile wheels than the more cumbersome steel channels; (*c*) by the use of a clincher rim, a more satisfactory fastening can be secured than by means of an ordinary flange channel.

2. The weight of wagons to which Swinehart tires may be fitted varies from 400 pounds to 5 tons. By varying the shape of tires and the compound of stock used, a satisfactory tire can be made for any weight of car which can be put in service.

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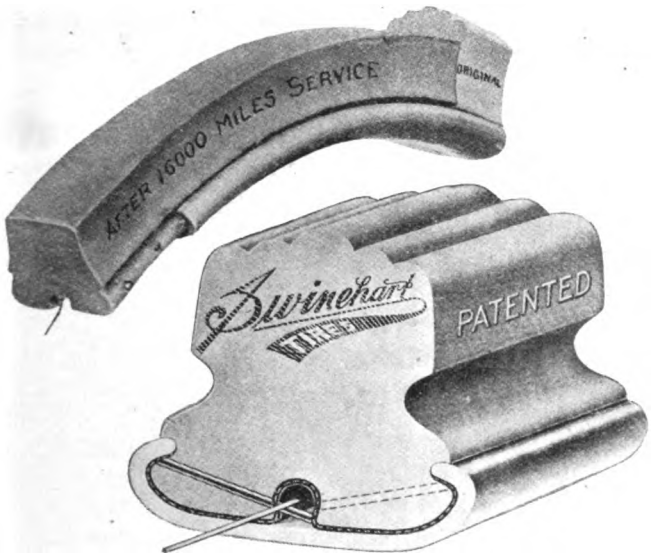


SWINEHART CLINCHER RIM POWER WAGON TIRE

3. We manufacture all sizes of solid tires from our 3 inch size which corresponds to a 3 inch pneumatic up to 7½ inch, actual measurement, truck tires. These 7½ inch truck tires are capable of carrying a load of 10 or 12 tons for the four tires.

4. The possible variation in construction to correspond with the various vehicle sizes and loads is unlimited. At the present time we are manufacturing a number of different shapes of tires, the concavity at the side of the tire cut to different depths in order to give more or less resiliency as the case may require. We also vary the height of the tire as in some cases the high tire is not desirable, especially when an exceptionally heavy load is to be carried. Our smallest tire is made with a very deep concavity on the side and is designed to carry only 250 pounds per tire, while our largest tire is made of the twin construction and is 7½ inches wide. It will carry from 2½ to 3 tons per tire.

5. The life of our tires in normal service on vehicles weighing from 1,400 pounds to 3,000 pounds is from 10,000 to 15,000 miles, varying with the condition of the road surface. In a number of cases, our tires have given more than 20,000 miles' service and this even on rough Belgian brick pavements. The speed in the above cases varied from 10 to 30 miles per hour.

6. The cost of reshaping any given size of tire is so small that it scarcely needs mentioning. A 3 inch or 4 inch tire can be reshaped or rebeaded, as we term it, that is, cutting new corrugations on the tread, at a cost of 50 cents per tire. This operation adds greatly to the resiliency of the tire and consequently to its service.

7. We do not recommend the wearing of tires very close to the rim. In fact would not recommend that tires should be worn down to a point less than 1 inch from the rim as this would scarcely leave rubber enough between the wheel and the road surface to take up the vibration due to uneven road surface. It is desirable to eliminate as much vibration as possible from the commercial vehicles as well as the pleasure vehicle and in order to accomplish this a body of rubber of sufficient size should be maintained between the tire seat and the road surface. The measurement above given, however, would vary greatly with the condition of roads. On rough stone pavements with car tracks raised above the street, it would not be advisable to run tires as low as 1 inch high. They should be at least 1½ or 2 inches in height in order to prevent the channels or rims from striking the car rails and projecting stones.

Firestone Company's Tires

The Firestone Tire & Rubber Co. of Akron, O., answers the queries, in the order given, and with further reference to catalogue and additional literature substantially as follows:

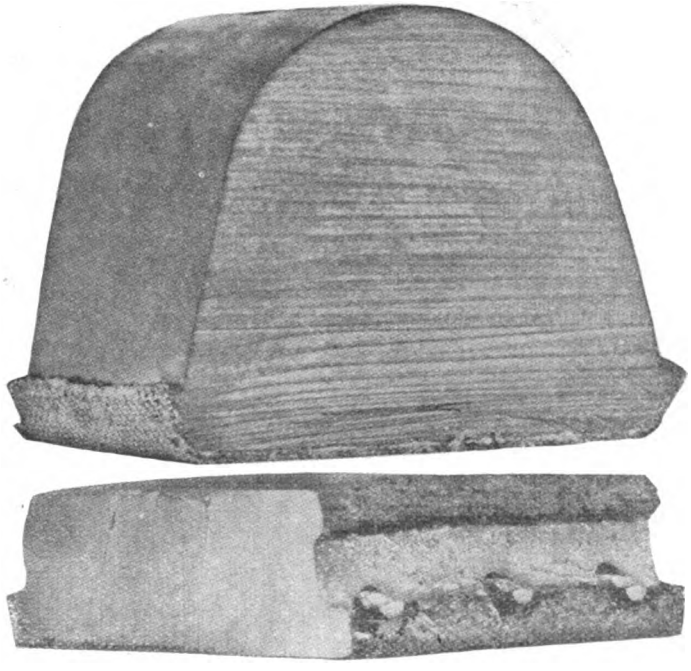
"1. The principle of our method of construction is a solid tire having lateral high carbon wires secured near the base of the tire and crossed by two high-carbon steel wires supported by the shoulders of the lateral wires—the latter when the tire is applied to the channel taking a longitudinal position at each side of the tire and resting on the lateral wires, called cross bars, and opposite the rubber tire and next to the inner side of the channel, being drawn into position at a very high tension.

"2. We will rubber-tire anything from a baby carriage to a 25,000 pound vehicle.

"3. We manufacture tires from ¾ inch in size up to 7 inches and including dual tires 8 inches across the base or more. We also make twin tires with a single base of 8 inches.

"4. We do not vary our construction on account of load variations, except on heavy vehicles where we place dual or twin tires to reduce the side strain and to act against skidding.

"5. It will be impossible to give actual life statistics on our tires, but where they are run under normal conditions very large mileages are obtained. They will vary all the way from 6,000 to 20,000 miles.



SECTIONS OF NEW AND WORN-DOWN 4½-INCH FIRESTONE TIRES—SIDE WIRES NOT SHOWN

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"As to cost of reshaping, or as we call it, repairing any size of tire, 10 per cent or less will cover the average repair and one-third more mileage than is ordinarily received may be obtained.

"7. As long as it does not injure the vehicle the tire can be worn as long as possible; in fact until it is worn down to the steel rim when another tire should be applied; or the rims will be damaged.

The accompanying illustration shows section of a 4½ inch Firestone motor truck tire (without the circumferential side wires), as it is when new, and below, how far it may be worn down, if the user desires to wear it down to that degree. The openings in the rubber around the crossbars indicate to what extent the chafing at the fastenings has affected the security of the latter.

One Dollar Fare Omnibuses

AN American counterpart to the London, Berlin and Paris motor omnibus movement is found in the "Sight-Seeing" companies here, who, by the simple expedient of hiring a man with a megaphone, are enabled to raise the bus fare from a penny per mile to a dollar per trip. No wonder, that so long as the sight-seeing method is agreeable to the public, investors are loath to spoil a good scheme by establishing common motor omnibus companies, in which they would be obliged to get their profits out of a nickel from each passenger. It is undoubtedly easier just now to get the dollar from the passenger than the profits from the nickel.

Probably there are other reasons which account for the backwardness of Wall Street in following the European example with regard to motor omnibus company flotations. The peculiarity that motor omnibus companies, requiring no street franchise, at least not a franchise conferring exclusive rights to certain routes, may not easily be capitalized by any other standard than the actual value of the rolling stock, depots and offices, probably militates strongly against their formation. The easy road to wealth, and the one which remains most popular because so smooth and well-travelled by the majority of those who constitute good financial society, has for many years followed closely the well-known methods, by which the original investment is shrouded in mystery, the earning capacity is boosted, regardless of economy, and emblazoned for the edification of the multitude, and the profits made not by the earning capacity directly but by admitting the multitude to a measured share in it.

Motor omnibus lines on a purely local scale, all within sight and a prey to competition, do not lend themselves readily to this form of wealth fabrication. As likely as not, it will be necessary to invent something quite different from the blunt European processes before our financiers will begin to take kindly to the new transportation method. The direct profits, while apparently respectable under a technically keen and rigorous management, are not sufficient for what we are accustomed to.

It is noticed that popular subscriptions have been opened in Philadelphia for motor omnibus projects. From 10 cents to one dollar per share! Perhaps a ride is thrown in at the latter figure. Developments may be looked for with interest. At the present moment it is difficult to discover the ulterior object, unless nothing more is contemplated than to sell some vehicles, and then to allow things to take their course as soon as the time arrives when all the vehicles will be in the repair shop because the popular management has not provided for their maintenance.

"SIGHT-SEEING" MOTOR VEHICLES IN NEW YORK READY TO START ON SCHEDULE TIME WITH FULL LOADS

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Four-Wheel-Driving

Economical Elements in the System As Applied to Gasoline Motor Trucks

WOOD TIRE WHEEL

OLD and new clash constantly in the power wagon industry, though it is so young, or perhaps because it is so young. But the clash is not real; only the clatter of words, the product of heated one-sided opinion, superinduced by supposed business interests. In the great slow moving tolerant world of realities where everything comes to him who waits and works, temporary dissensions are washed by the current of events into the gulf of oblivion, with not much more than the laugh at anyone who thought he had a monopoly on correct understanding—in this case on correct design and correct gauging of the public's requirements in the matter of power wagons.

There is nothing *very* old in power wagon construction, no hoary-headed veteran among design features to which reverence is due—if reverence can ever be more than a free offering—but there are a few features which have withstood the onslaught of improvers with more than ordinary tenacity, and when they are attacked anew everybody whose "bump of reverence" or of caution, is well developed, or who has vested his interests with the attacked features, shudders. But, as some modern philosopher has said—was it George Bernard Shaw or Nietsche or Ruskin—"Whoever is not gay, is insane." There is no reason for shuddering. In the long run, the old will hold its own, and the new will hold *its* own. The field for motor vehicles and for power wagons is immense and varied and affords scope for many different lines of construction. And each of these lines—whatever their number—will be capable of standardization within its limits. There will never be a standard embracing them all. The specimens of each will yield profits to users in proportion to how appropriately the type is selected for the class of work for which it is best fitted.

These reflections, and many more that remain unvoiced, are occasioned by the advent of the four-wheel-drive power wagon and all that goes with this construction.

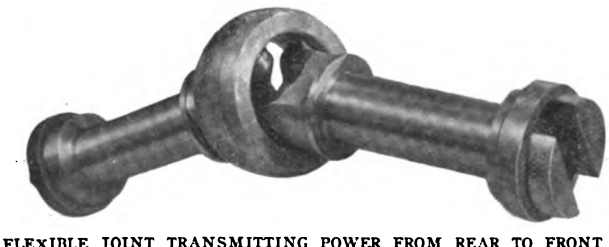
It has been proved that power wagons—all the three or four classes, gasoline, steam, electric, gasoline-electric—are friends of the business man who half-tries to use them right, each in its field (though this does not deny that the fields overlap); and the four-wheel-drive is not among their design features; neither is four-wheel-steering or wood wheels.

Now comes the four-wheel-drive truck, or omnibus—of the gasoline or of the electric class or of the mixed gasoline-electric class, for that matter. After many difficulties have been conquered, it is in the market. It is going to win a field of usefulness for itself. How large? Who shall say! How superior within its field? Again, who shall say!

It is a reality, however, and one so radically divergent from customary construction that it commands attention. It is quite possible that it may mean more financially to some business men to choose right between four-wheel and two wheel drive than to choose right between the electric and gasoline systems. On account of the highly important part played by the power transmission methods in gasoline vehicles, the application of the four-wheel-drive principle to them becomes a matter vastly different from its application to electric vehicles or gasoline-electric vehicles. The two must be considered separately.

In order to see where the four-wheel-drive gasoline vehicle stands and for what field of work it bids, it is necessary to examine how the difficulties of the construction have been overcome or turned to advantage in the vehicle most prominently representing the type. This is the four-wheel-drive motor truck made by the Four-Wheel-Drive Wagon Company of Milwaukee.

Anticipating somewhat what the design will show, it may be said that this vehicle belongs among those which are expected, like most of the British steam drays, to make money for their owners more by high load capacity and ability to haul loaded trailers—combining the qualities of a truck and a tractor—than by high speed. Yet so greatly is horse-speed reduced in heavy trucking, coming down to an average of little more than two miles per hour, that any motor truck, even the slowest, finds no difficulty in doubling and trebling this average. Slowness is not inherent in the four-wheel-drive principle, as such, however. The Milwaukee truck is powered and geared to three, five and eight miles per hour. It can be geared to a high speed of fifteen miles per hour. It is practically the choice of wood tires in preference to rubber tires and the policy of the manufacturing company which make it a slow speed and large load truck. Apparently there is nothing in the design to prevent the use of rubber tires and higher speeds, if that practice were preferred on general principles. In other words, the wood tires are used because they may be used with a four-wheel-drive, not because



FLEXIBLE JOINT TRANSMITTING POWER FROM REAR TO FRONT

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they must be used. The philosophy of the truck is in summary, then, as follows:

Means being found, in four-wheel-drive and steering, for securing traction for very large loads, even when the roads are bad (that is the claim), the doubtful end of high speed—that above three, five and eight miles per hour—is deliberately surrendered in return for tire economy accomplished by the use of wood tires. The value of speed above certain limits—varying with loads—is doubtful. The value of rubber tires below certain speed limits—also varying with loads—is also doubtful, (especially because vehicle springs can take their place in protecting the vehicle mechanism at low speeds but cannot do so at higher speed). Both are thrown out. The doubtful gain from the speed is swapped against the doubtful economy from wood tires, but higher average load capacity is secured to boot. Certain complications in construction, involving additional wearable (but replaceable) parts, are the price paid.

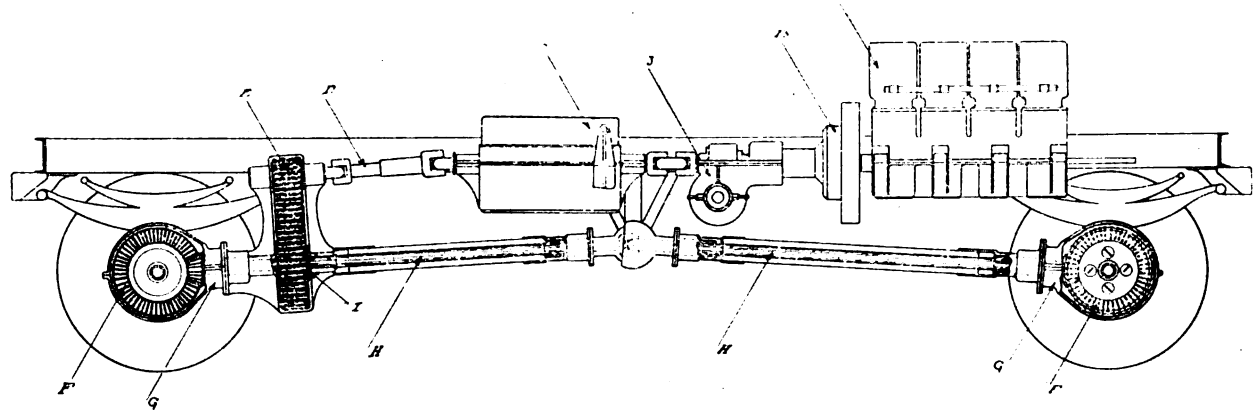
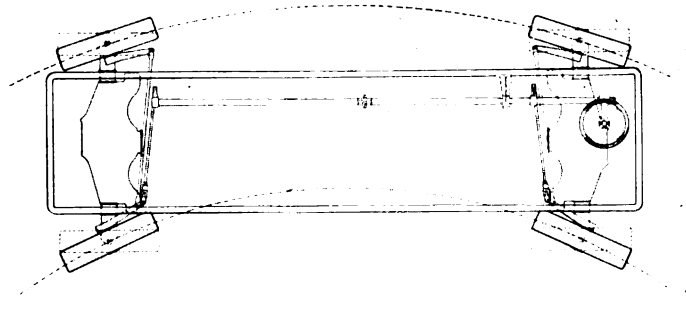


DIAGRAM OF THE DRIVING MECHANISM, SHOWING CONNECTIONS BETWEEN THE ENGINE AND BEVEL GEAR DIFFERENTIAL ON THE WHEELS
A—Engine. B—Clutch. C—Change Gear Box. D—Engine Shaft. E—Morse silent chain belt. F—Axle differentials. G—Hollow axles. H—Main shafts. I—Front and rear differential. J—Motor winch.

The Four Wheel Drive

The engine is placed in front with the engine-shaft running lengthwise of the car through the clutch and transmission. The shaft terminates in a sprocket just ahead of and above the rear axle. A five-inches wide Morse silent chain-belt connects this sprocket with a sprocket placed on a driving shaft running below the engine shaft, from the front to the rear axle. This lower shaft, in turn, by means of bevel gears, drives the shafts located within the hollow axles.



STEERING SYSTEM WITH FOUR-WHEEL DRIVE

In order to give each wheel independent speed when turning corners and traveling over uneven road surfaces, there is placed within each hollow axle a differential gear in the usual manner of bevel-gear driven cars, and in addition to this, there is also placed upon the lower shaft, running from axle to axle, a third differential in order to allow difference in speed between front and rear wheels.

These differentials are especially designed for heavy service and are made by the Warner Gear Co. The bevel gears and pinions are 2¾ inches wide, 1⅛ circular pitch involute teeth, case hardened, and designed to give three years' constant service. Gears for replacement, are furnished by the manufacturer at $100 per set; complete, front and rear.

All driving shafts range from 1⅞ inches to 2 inches in diameter. All shaft gears, universal joints and entire driving mechanism are stronger than the engine and will stop the engine in case of overload without themselves being injured.

Roller bearings are used in connection with axle differentials.

The Four Wheel Steering

In steering all four wheels the axles remain in a constant and fixed position under the car and do not swing or turn. Steering is accomplished by swinging all the wheels upon vertical pivots by which they are connected to the axles, very much in the same manner as the front wheels of any automobile are steered, excepting that instead of having a steering knuckle on the inside of the wheel as is the custom, no steering knuckle is used. The axles terminate in the center of the wheels and are connected to the bearing ring of the wheels by means of vertical pins. The bearing ring is of much larger diameter than the axles and is therefore readily swung in any direction about the vertically placed pins, thus giving direction to the wheel, which is mounted upon this swinging bearing-ring and rotates upon it by means of its universal-joint connection with the driving shaft located within the hollow axle. All wheels steer together from one steering wheel and track perfectly when rounding a corner, so no calculation is necessary as to where the rear wheels are going to strike.

Axles and Brakes

The supporting-axles are each a one-piece hollow steel casting reaching from wheel to wheel and weigh 500 pounds each. Within them are mounted the differential gear connected in the usual manner with the driving-axle

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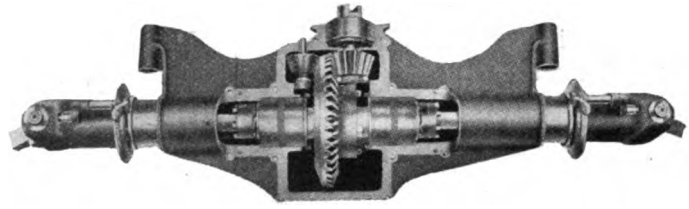
terminating at each end in a flexible or universal joint by which motion is transmitted to the wheel, whether the latter is in its normal position or turned. It is understood that the joints are made of tool steel and easily replaceable when wear becomes noticeable.

The wheel brake mechanism is naturally also affected by the necessity of applying them regardless of the wheel position relative to the axle. This is easily accomplished, however, by working the brake-expanding lever directly in line with the vertical pivot pin around which the wheel turns. A patented device is used for this purpose. These wheel brakes are 24 inches in diameter and 2 inches wide, of the internal-expansion type and mounted within each wheel. They are operated by a long hand lever at the driver's seat. In addition, a transmission brake is mounted upon the main engine shaft between the transmission and the clutch. This is operated by the clutch pedal. The first part of the pedal movement releases the clutch; further pressure sets the shaft brake, so as to act upon the whole machine when gears are left in mesh.

Wheels and Tires

The wheels are of the disk type, 36 inches in diameter, with wooden tires 8 inches wide. Ball bearings, 11 inches in diameter and containing 48 ¾-inch balls, are used. There are two bearings on each wheel which furnish safe carrying capacity as far as the bearings are concerned, of at least 300,000 pounds; a load ten times greater than the entire machine will ever carry.

The wooden tire is made of seasoned rock elm, sawed into wedge-shaped blocks with fibre lengthwise, which are glued and nailed together until they form a circle. They are then turned to size and a shoulder one-half inch wide is formed on each side of the tire 2½ inches from the tire surface. A heavy steel ring with a corresponding shoulder is then shrunk over the wooden shoulder on each side of the tire, having very much the same effect as an ordinary steel wagon-tire in holding the wood together and drawing toward the center. Bolts are



HOLLOW AXLE WITH DIFFERENTIAL AND JOINTED DRIVE SHAFT

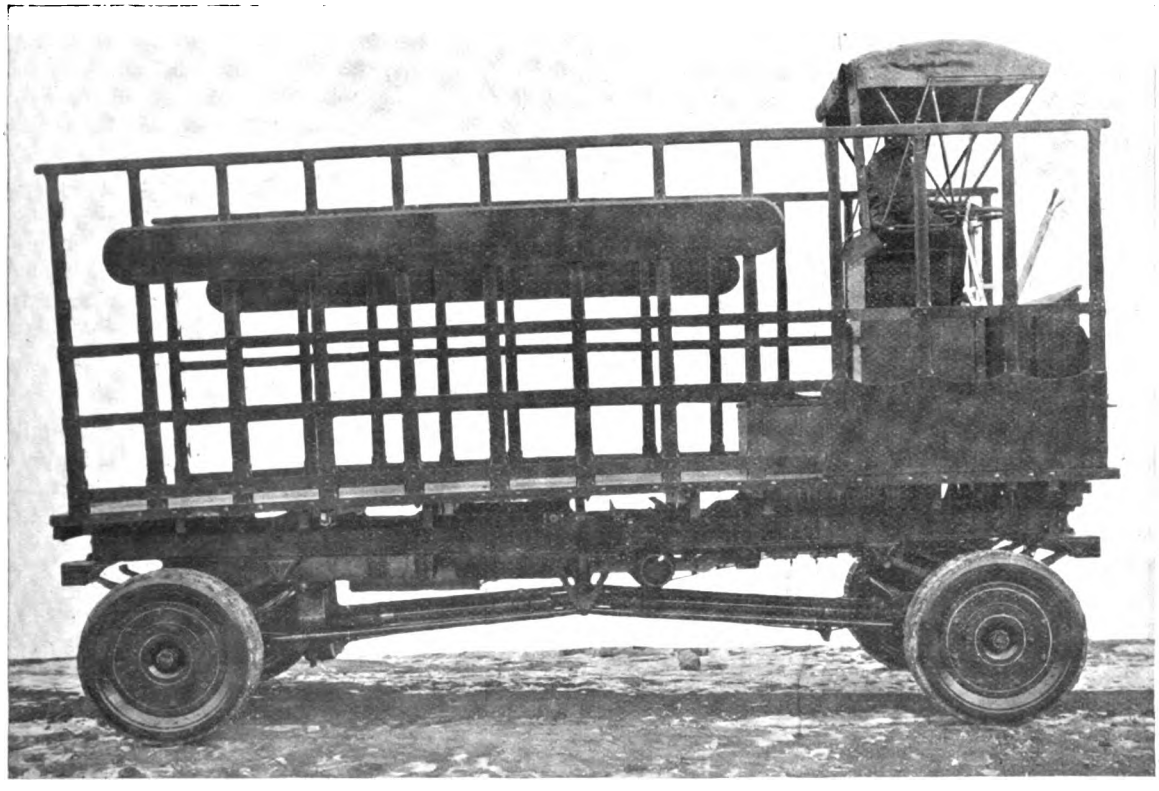
run through these rings and wood blocks from side to side to prevent the blocks from splitting sidewise.

To increase the length of life of this tire, steel wedges ¼-inch thick are driven crosswise into the face of it 2½ inches deep around the whole tire about 3 inches apart. These wedges prevent the tire from slipping and do not harm any pavement, as they are flush with the wooden blocks.

The tire reaches clear to the hub, doing away with spokes, and is slipped over the hub and held in place by a removable flange bolted through the wood to the fixed flange on the opposite side of the hub.

Other Design Features

No other features in the design of the Milwaukee Four-Wheel-Drive wagons are necessarily of special construction, except in so far as they are adapted to the very heavy loads which the vehicles are intended to haul. The clutch, for example, is of the multiple-disk type, consisting of ten alternating steel and grey-iron disks 10 inches



FOUR-WHEEL DRIVE WAGON COMPANY'S GASOLINE MOTOR TRUCK—EQUIPPED WITH WOOD TIRE WHEELS

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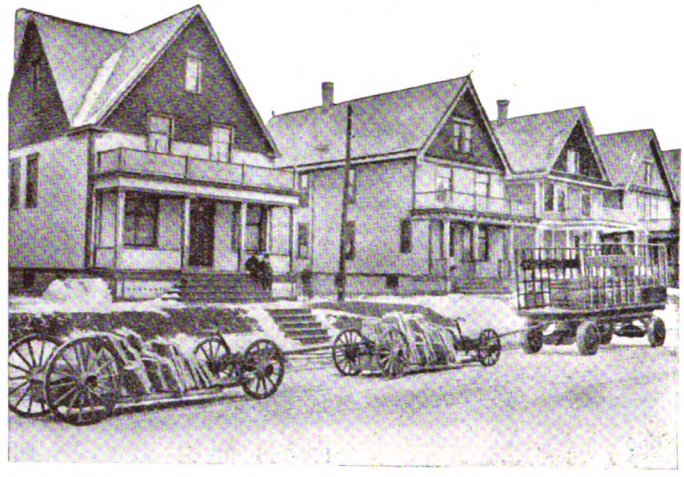
in diameter, operated by cones and run in an oil bath. The power transmission or, rather, change-gear mechanism is of the sliding type with three speeds forward and reverse. There is placed "amidships" of the wagon on the right hand side, a winch, or a windlass which may be utilized, by making the proper connections, for loading and unloading heavy pieces. It operates either in conjunction with or independently of the wheels, and is sufficently powerful to move the truck in case of accident. The engine comprises 4 vertical cylinders, 6 by 6 inches, water jacketed, developing 45 hp. at 750 revolutions and capable of higher speed with gain of power. The ignition is double, either by battery, coil and timer or by high-tension magneto, separately wired. The cooling system includes a radiator with 225 square feet of radiation surface placed across the front of the truck under the driver's footboard, and two fans, 19 inches in diameter operated at 3,000 revolutions.



MILWAUKEE TRUCK HAULING THIRTEEN TONS NET WEIGHT OF LOAD BY MEANS OF TWO TRAILERS

Can Differential Gears be Spared

DIFFERENTIAL gears are subject to wear and breakage and cause skidding. This is the brief arraignment of differentials, which makes it desirable to dispense with this construction feature in motor vehicles in general and in commercial power wagons in particular. All attempts in this direction have so far proved futile. The best that could be done was to lock the differential whenever there was a difficult piece of road ahead. For city traffic this was not practicable, and at best it was a cumbersome complication. So the world at large is still looking for something to take the place of the differential gear for rear-driven vehicles, it being admitted that in front-driven vehicles the differential does not cause skidding easily, and also, of course, that differentials may be so substantially designed and made that the question of wear and breakage is reduced to small importance.

Any device which will effectually accomplish the purpose of the differential without bringing in a new set of objectionable features, may be considered the ally of the rear-driving system, which is still in absolute majority in motor vehicle propulsion and is considered the simplest and most practicable system by ninety-nine out of a hundred manufacturers.

From this point of view the Hedgeland Solid Anti-Skid Axle, which has now been on the market for some time and has also been shown and demonstrated in Europe and caused widespread notice, invites the attention of power wagon users.

It is illustrated herewith, in its application to three different systems of driving.

The makers say:

"The Hedgeland axle is a continuous shaft and it drives both wheels alike, no matter how unequal the resistance to the two may be. In rounding a curve, when the outer wheel is called upon to exceed the speed of the inner wheel, it automatically disengages and runs free of the axle until the axle catches up with it, when it again engages. The car is always driven square from behind. On a curve the inner wheel does the driving, and counteracts the throw of the machine. No matter how slippery the surface, this inner wheel will hold up against the throw of the car, so long as the clutch is kept in. With the clutch out, the car is running on four free wheels and it may slide exactly as a horse-drawn vehicle will slide. But the car *cannot be made to skid.*

"On the Hedgeland axle neither wheel can quit work until it is *running faster than the axle is driving it.*

"When you throw out your clutch everything behind it becomes idle, transmission, shaft and axle. This feature is extremely important if your car has the sliding gear transmission, because you can change gears at full speed merely by throwing out your clutch, the gears engaging an idle shaft.

"A check to one tire does not mean a slip for the other. You never see one wheel polishing down the tread to its tire because the other wheel is in trouble. A short slip wears down more than a long pull. You are likely to save enough on your tires in one summer's touring to pay for your axle."

As the illustrations show the mechanism clearly a very brief description will suffice:

The axle is a continuous steel shaft. The clutch

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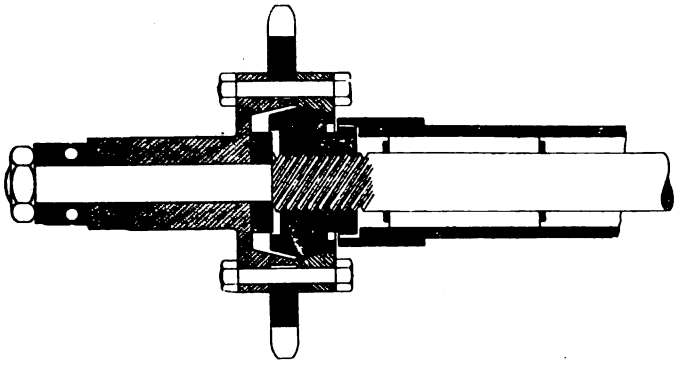
is a nut threaded interiorly to engage the thread on the shaft. It locks the wheel to the axle and releases it automatically by riding out or in on this thread.

The drawings show the nut in position to drive the car ahead. The twist of the axle has drawn the nut in,



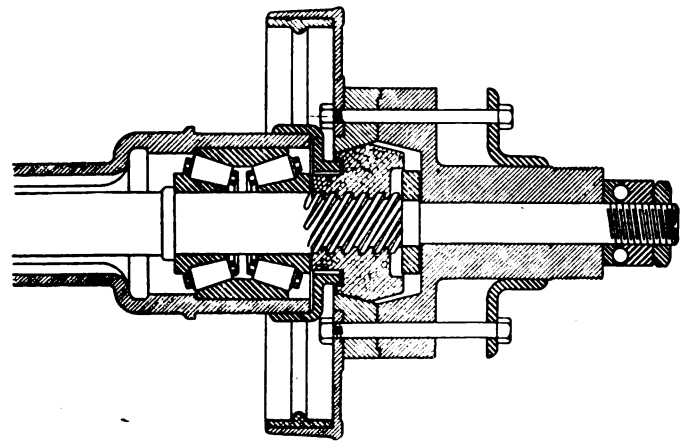
HEDGELAND CLUTCH ON JACK SHAFT—IN CASE OF SIDE CHAIN DRIVE

screwing its wedge shaped face into its seat which is the interior surface of the hub, and holding it there. But the smallest call upon the wheel to exceed the speed of the axle screws the nut out on the thread to the point at which neither of its faces is engaged, and the wheel is riding perfectly free on the axle, exactly like a buggy wheel. If the axle is reversed, the nut is screwed clear across, so that its outer face is engaged against the other face of the hub, and the car backs up. In this position it is equally permitted to run free in excess of the speed of the axle.

The only remaining feature of the device to be mentioned is the small tension collar. This is put in for the purpose of counteracting the friction between the screw and the nut. It gives the nut a constant tendency to draw into engagement, and thus makes the engagement instantaneous upon the speed of the axle overtaking that of the wheel.

It is to be noted that the clutch is not, strictly speaking, a friction clutch. The wedge is driven to its seat instantly by the positive action of the screw, so that there is no slip, and therefore no wear.

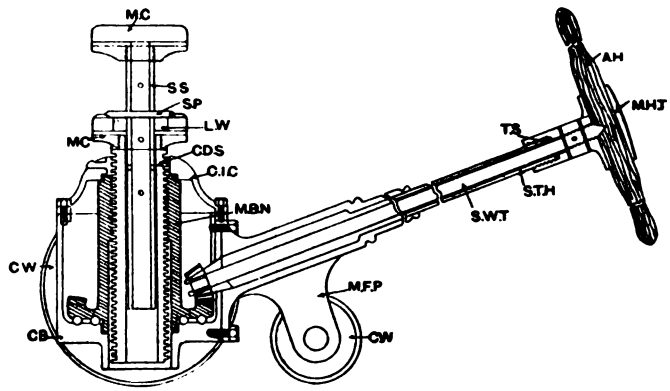
The most obvious question which suggests itself to the power wagon user in considering the value of the Hedgeland device relates to the distribution of driving power between the two driving wheels. On rounding a bend in the road—uphill and with a heavy load for example—the Hedgeland device manifestly throws the entire burden of driving upon the inner driving wheel, the outer wheel in the curve described running free, while a differential gear distributes the traction effort between the two wheels. Whether any troubles are likely to arise incidentally to this feature, in heavy hauling, is a question which can only be answered satisfactorily by searching test under severe road conditions.



HEDGELAND CLUTCH APPLIED TO "LIVE" REAR AXLE

JACKS FOR HEAVY LIFTS

JACKS adapted for raising the axles of heavily loaded vehicles are so scarce that most automobile supply dealers have nothing to offer customers who write for them. One of the reasons for this condition in the market is probably that ordinary jacks are offered so cheaply that no manufacturer has had the courage to produce one which would necessarily cost much more. Two thousand cheap jacks—guaranteed to break the cast iron cogs under a very moderate load—were, for example, recently offered in the supply market as a premium on a purchase of another job lot of fairly current merchandise, without takers.



CONSTRUCTION OF JACK FOR POWER WAGONS

M C, malleable iron claw
S S, steel stem
S P, steel pin
L W, loose washer
C D S, cold drawn steel screw
C I C, cast iron cap
M B N malleable bevel wheel and nut
C W cast iron wheels
C B, cast iron body
M F P, malleable front plate
S W T, solid wrought iron transmission rod
S T H, steel tubular handle
T S, thrust socket
M H T, malleable handle tee
A H, ash handle

Under these circumstances which, rightly seen, bespeak the need of good jacks rather than cheap ones, the following description of a jack produced in the British market especially for heavy power wagons, omnibuses and limousines, will be of interest:

The steel stem S S, with its malleable claw M C, is set roughly at the height required by means of the steel pin S P, which lies across the loose washer L W, this being in turn supported by the lower claw.

When the jack is in position, the lifting force is given by turning the handle A H, the convenient position for which should be noted. End thrust is taken up by the thrust socket T S, and, the torque being transmitted through the solid wrought-iron rod S W T, causes a rotation of the screwed sleeve M B N through the medium of the bevel gearing.

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Scrap Book Records for Wagon Owners

PRESS REPORTS OF ADVANCEMENT IN THE USE OF POWER WAGONS IN AMERICA—WITH COMMENTS

NO DENATURED ALCOHOL FOR SENATE

WASHINGTON press correspondents announce that the Senate is preparing to kill the "free-alcohol" bill.

"The action of the House of Representatives in passing the bill by an overwhelming vote of 222 to 7, made it appear that the bill would go through the Senate with very little opposition," writes one of these hopeful journalists to a contemporary automobile journal, "but since then a number of things have come up to cloud the issue. The proposition has been made to attach the Philippine tariff bill to the free alcohol bill in order to force the former through the Senate, and quite a number of senators have come out boldly in favor of such a proposition. If this action is taken it will strike a death blow to the alcohol bill.

"At this writing the bill is pending before the Senate Finance Committee, and it has not yet been determined whether the committee will grant hearings on the bill. Extensive hearings were given before the House Committee on Ways and Means, and it would seem that the entire situation had been gone over so thoroughly that nothing new could be adduced. There has been some talk of making the alcohol bill a tariff issue, and if that is done the situation will become so complicated that nothing can save the bill at this session of Congress.

"Still another stumbling block in the way of the alcohol measure is the railroad rate bill. If the debate on the latter measure is extended, there will undoubtedly be opposition to reporting the alcohol bill to the Senate before the next session. All in all, the situation is anything but promising for the free alcohol bill."

[As explained in previous issues of this publication no immediate interests of the motor vehicle industry are involved in the passing or not-passing of the "free denatured alcohol" bill, except indirectly through the effect which the use of alcohol instead of gasoline for lighting and heating and for stationary engines may have to keep the price of gasoline for motor vehicles down to a reasonable maximum. Something of value may yet come from the Senate's deliberations on the subject, if this body will bring out the technical difficulties which exist against using alcohol in internal-combustion engines in which throttling must be accomplished either by varying the compression or by varying the composition of the explosive mixture. In the testimonials submitted to the House of Representatives by such authorities as Prof. Elihu Thompson, these difficulties are glossed over in speaking of the availability of alcohol for motors, generally, without distinguishing between stationary motors operated with a small range of power variation, and vehicle motors normally operated with an exceedingly large range of power variation. It also remains for the Senate to probe the advisability of adopting methyl (wood) alcohol as a denaturant by law, when the German experience, invoked in other respects in favor of the "free alcohol" bill, is distinctly against its employment and in favor of benzol. Perhaps some delay in the Senate, while deplored and criticised under the suspicion that it is generaled by the wood alcohol interests, may eventuate in better "free alcohol" legislation than the half-measures which were accepted by the House. Some other important industries will suffer from the delay, but the motor industry, including stationary, marine and vehicle motors, can afford to wait for free ethyl alcohol better than it can afford to accept a special article, such as ethyl alcohol mixed with methyl alcohol in a certain legalized proportion must always remain, with all the drawbacks and restrictions which must attach to the manufacture and distribution of such an article. The agitation which has taken place for "free denatured alcohol" will supply an excellent basis for broad, public discussion of a real "free alcohol" plank in one of the national political platforms, where the subject by its great importance belongs, though there is small chance that one campaign would suffice to break down the two principal barriers to "free alcohol," viz., the fiscal interests of the United States government and the objections of those who believe that the people of this country are unfit to govern themselves when tempted by cheap alcoholic liquors].

* *

RURAL MAIL DELIVERY

E. P. CHALFANT has the following to say on the economy of mail delivery in rural districts by motor power:

"As applied to the rural mail service, it does not follow that an automobile can be used on every one of them, for some routes are too rough for a horseback rider to travel safely; neither is it certain they can carry the mail 300 working days a year. But there are hundreds, perhaps thousands, of routes where an automobile can be driven satisfactorily for at least 250 days a year. It is not even necessary to keep a horse for use in emergencies, for a horse can be hired from the nearest livery upon occasion, and for a small amount.

"Compare the expense and the results obtained by the automobile as against the team.

"It is safe to estimate that a carrier requires an average of two and a half horses a year, or at least the expense of same. Two good horses are worth $100 each; a mail wagon, $75; two sets of harness, $25; the cost of keeping will average $10 a month for each horse, and the shoeing and doctoring, as well as repairs of the wagon, amount to a considerable item in the course of the year. An early morning start and a late finish make a full tiresome day for a carrier.

"Opposed to this is the Orient buckboard, at a first cost of $400 and expense of a half cent a mile for gasoline and oil, an average expense of three to five dollars per month for repairs and renewals, which includes tires, the principal cost of an automobile. Under ordinary usage on the road a set of tires should last about fifteen months. The cost of renewing tires amounts to $13.50 each. The route is quickly covered and the carrier has three or four extra hours at his disposal in which he can earn extra dollars on the side, and what could be easier than carrying passengers in his car, for which good, substantial rates can be charged."

* *

ADVICE BY PRACTITIONER

"MAKE it a rule never to suspect or tamper with the carburetter, valves or compression until you are absolutely certain that the ignition is in working order," says a motoring M. D., whose car is on the go morning, noon and night and frequently after midnight, so that his advice should carry some weight. "In my experience, which extends over two years steady going, and years with me mean 365 days, not pleasant summer weather alone, I have found that fully 90 per cent of my troubles have been traceable to the ignition, and by this I do not refer to the ignition system only for there are many things which affect it indirectly. For instance, not long ago my car developed a very annoying miss, which on account of its having but a single cylinder, meant a loss of power sufficient to hamper me a great deal. The car had to be nursed and coaxed over every little rise which under ordinary circumstances would not affect it in the slightest, and muffler explosions would occur every now and again—with startling regularity, one might say.

"If I had taken the piece of advice I have just given you, I would have discovered the trouble several days sooner and not suffered anything like the delay to which I was put by the car being practically out of commission, for the engine could not be depended upon to turn over a dozen times without a miss. But the first thing I attributed it to was the carburetter, and over the carburetter I fussed unceasingly, taking it down and putting it up again without the slightest result, adjusting it a hundred times in the course of an hour without the faintest glimmer of hope, although the spasmodic manner in which the engine would at times pick up and run finely often encouraged me to think the defect had been remedied only to have despair sink deeper than ever upon trying it

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under load. There's no question in my mind that it was one of the most exasperating things that I have come across, but once I had cured it, it did not take me long to see what a great amount of time I had wasted in fooling with the carburetter.

"Of course, I did not confine my attention to that altogether; I took turns in testing the coil, batteries and plug, even replacing the latter with no permanent benefit, until finally an examination of the points revealed the cause. The engine is of the horizontal type so that any excess of oil in the crank case readily finds its way back into the combustion chamber, and that was my trouble. The whole engine was simply flooded with oil and although the plug is seated in a pocket in the upper side of the cylinder the oil was splashing on it continuously, thus effectively insulating the plugs. Running for half an hour or more without feeding any oil promptly showed that the ignition was at the bottom of it as usual. The system itself was not at fault, but other causes had contributed to prevent its working, which amounted to the same thing, for all the engine needed to perform its work regularly was the spark. Take my advice and look to the ignition first, last and all the time—it is soon enough to worry about the carburetter or something else when you have made sure that the spark is taking place when and where it is most needed and the best coil, batteries and timer ever invented are not much good if the plug is choked up, whether it is soot or oil."—*Motor World.*

* *

MUNICIPAL POWER WAGONS

NEW YORK City now owns twenty-seven automobiles, and, if the requests made by the heads of the various departments of municipal government are granted by the Aldermen and the Board of Estimate and Apportionment, thirteen new ones will be added to the number, bringing the total up to forty, representing an investment of $125.000. Many of the cars among the present twenty-seven, however, were bought at second-hand.

Appropriations have already been granted for two new machines each for the presidents of the Boroughs of Manhattan and of Brooklyn, and the purchase of two others, at a cost of $6,250, for the Commissioner of Bridges, has been authorized but is yet to be approved by the Board of Estimate. The Commissioner of Police has asked for three automobiles, to cost $16,-500; the Commissioners of Street Cleaning and of Docks and Ferries each want two. The Deputy Fire Commissioners in Manhattan and Brooklyn want two electric runabouts.

The Fire Department is now the largest holder of autos, Chief Croker's Locomobile being the most expensive of the five, in cost $14,250 in the aggregate. Second in the list is the Department of Health, which has four that together represent an investment of $9,700. The Park Commissioners of Brooklyn and Queens and the President of the Borough of Richmond follow with four each, but of less aggregate cost.

* *

LAWMAKERS KNOW NO TRUCKS

"THERE is no possible question that the law as it stands requires the registration of all motor vehicles, and the purpose for which they are employed is of no significance," says Austin B. Fletcher, secretary of the Massachusetts Highway Commission, speaking of the administration of the automobile laws of that state. "The Commission has never made any distinction and has not considered any necessary. Commercial vehicles must be regularly registered and must carry numbers, lamps, gong or horn, etc., and their drivers must have licenses. On the matter of what shall be considered as coming under the operation of the law the original statute of 1903 is very explicit, and though the law has been frequently amended the section specifying the scope of the statute remains in its original form as it came from the legislature."

* *

TURNING SHARP CORNERS

THE Wisconsin Auto Transit Company, which was recently formed to run a stage between Monitowoc and Kewaunee and intermediate points, has decided to make the regular passenger rate 4 cents per mile, but will issue ticket books for 33 miles each at $10, with the intention of selling as many of these ticket books in advance of the establishment of the line on the subscription plan, thereby facilitating the financial floating of the enterprise. The purchasers of the ticket books are to pay $5 as soon as they see the line in operation, and the other $5 thirty days later.

* *

MOTOR TRANSER LINE FOR MACON

CITIZENS of Macon, Ga., under the lead of H. J. Lamar, are negotiating for the establishment of an auto transfer line, the main business of which will be hauling of merchandise. It is the intention to buy three trucks for freight service and two omnibuses for passenger traffic. In looking around to secure these vehicles it was discovered that considerable difficulties exist in obtaining deliveries from the manufacturers, and in consequence another plan is on foot for establishing a factory in the same city. "The parts composing the machanes," says the Hon. Ben L. Jones, who is the moving spirit of the plan, "may be bought and shipped south where the machines can be assembled pust as well as at points east and north where machines are now being built. The demand for machines shows conclusively that the supply throughout the country is far short of the orders, then why cannot a factory in the south be made profitable?" Mr. Jones is said to be a business man who has heretofore been successful in all his undertakings.

Charles W. Gray, of Watertown, N. Y., has secured two Panhard gasoline vehicles remodeled as omnibuses, one to carry 14 passengers, the other 24 passengers, and intends to operate a public bus line on and after May 1.

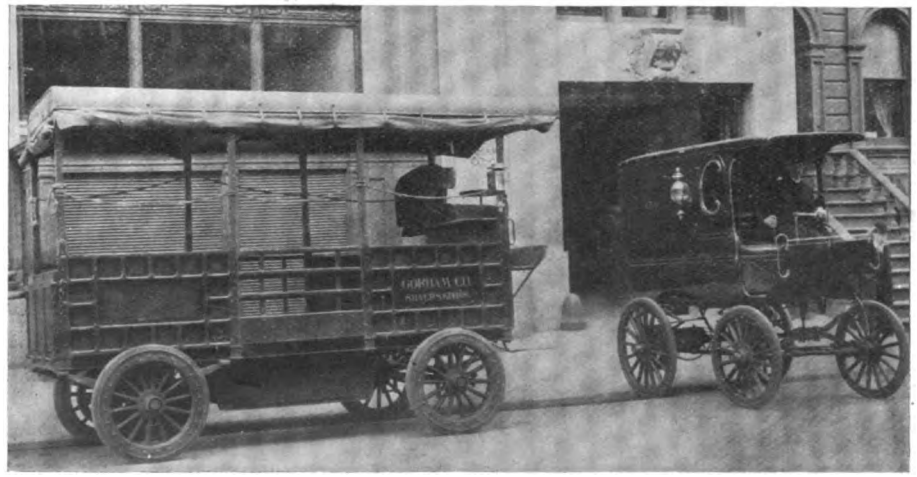
A twenty-passenger automobile has been placed in operation between Sanford and Orlando, Fla., twenty-two miles apart. The car meets the Clyde line boats at Sanford every day.

An automobile livery service will be conducted by F. A. Dustin, of Fresno, Cal., in connection with a regular garage and repair business. The garage owner sells Pope automobiles.

Mrs. L. McGovern's 3-story horse stable at 1722 Broadway, New York, has been leased by J. Michaels for use as a garage, after remodeling and the addition of a 3-story fireproof extension.

Jacksonville, Fla., will soon have a modern garage under management of Robert Neims. The floor is of cement, the walls of white vitrified brick, the ceiling of pressed steel, trussed.

A brick and concrete fireproof garage with repair shops and power charging



NEW ELECTRIC TRUCK AND SEVEN YEARS OLD ELECTRIC DELIVERY WAGON WITH GORHAM & CO., SILVERSMITHS—NO VISIBLE "DEPRECIATION"

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plant for electric vehicles will be erected for the Colonial Automobile Company of Pittsburg at Shadyside.

Cook and Covey, of Portland, Ore., are erecting a large garage with inclined runway to the second floor.

* *

MOTOR CYCLE ECONOMY

WRITES Charles Q. Turner: "I know a man who used a motor cycle, with a storage capacity of a hundred pounds, for six months, on which he rode from 50 to 100 miles a day, at a cost of $1.25 a week. This cost has been verified in several competitive tests in which the little giants have made from 16 to 30 miles out of a measured pint of gasoline, and several machines have carried passengers nearly 200 miles at a cost of 22 cents per passenger.

* *

MOTOR CYCLES IN BUSINESS

THE motor cycle has a commercial side which the bicycle never possessed. This is due to the fact that propulsion is by other motive power than the rider, so that conveying large packages, bundles and other weighty bulky merchandise is rendered possible when formerly it would have overtaxed one's strength or that of the vehicle itself, conceding that it were possible to so balance or adjust these things on the wheel. For instance, postmen can and in some places do use motor cycles as an adjunct to the speedy and easy delivery of mail matter. Small shop keepers or those who must needs deliver certain packages immediately easily solve the difficulty by calling in to their aid the motor cycle.

The motor fire engine has been introduced into the service of many fire brigades, both here and abroad, and a further extension of the use of motors has been adopted by the introduction of a specially built motor cycle for the commander of the fire brigade in Altona, near Hamburg. The neat little motor cycle is fitted with a 3 hp. engine, and proves very useful on account of the speed with which it enables the commander to be, in a very short time, at the fire and take personal command. There is no doubt but that this innovation will be generally followed and adopted.—*Outdoor News.*

* *

RAILWAY MAGNATE TO BUILD VEHICLES

SO great has been the success of the motor cars recently operated on railway lines, that E. H. Harriman is now reported as planning to build a model town on land 10 miles west of Omaha, Neb., for the purpose of establishing there the manufacture of motor cars, chiefly for railway purposes, as the chief industry of the town.

* *

TAXIMETERS FOR THIS COUNTRY

THE devices which have been used by the thousands in Germany and France for controlling the distance travelled by motor cabs as well as horse cabs in public service, are now to be manufactured in this country, the American Taximeter Company having just been incorporated in the state of New York with capital stock of $200,000.

* *

ONE MONTH OF DELIVERY

Manufacturers Give Data of Delivery Work with Wagon and Cycle Carrier

THE following results of one month's delivery service with a friction-drive Carter gasoline delivery wagon for the J. L. Hudson Company, of Detroit, are reported by the makers of the vehicle, the Motorcar Company, of Detroit:

	Deliver's	Miles		Deliver's	Miles
Mar. 6	87	56	Mar. 23	52	46
" 7	71	46	" 24	105	56
" 8	65	54	" 26	52	48
" 9	33	48	" 27	65	55
" 10	101	64	" 28	66	58
" 12	60	52	" 29	57	52
" 13	71	49	" 30	67	49
" 14	85	52	" 31	136	67
" 15	84	59	April 2	61	49
" 16	60	58	" 3	92	50
" 17	104	56	" 4	95	54
" 19	65	44	" 5	98	49
" 20	64	55	" 6	78	44
" 21	54	39	" 7	147	70
" 22	74	65	Total,	2249	1544

Average miles per day..... 53.28
Average number of deliveries per day, 76.86
Distance travelled per delivery..... 0.68
Miles per gallon of gasoline..... 10.6

On the five Saturdays shown by the foregoing record, easily distinguished by the increased mileage and stops, the following averages apply:

Average number of deliveries per day, 118.6
Average number of miles per day.... 62.6
Miles travelled per delivery..... 0.53

The hours of service were:

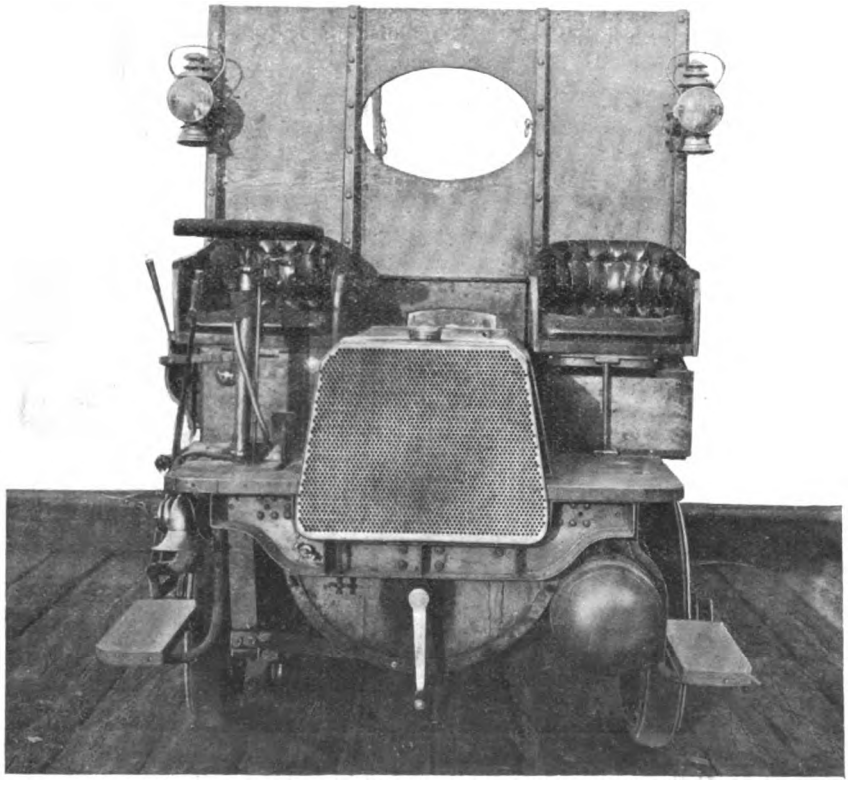
Out With Load	Return to Store
9:30 A. M.	11:00 A. M.
11:30 A. M.	12:00 M.
1:30 P. M.	3:00 P. M.
4:30 P. M.	5:30 P. M.
7:30 P. M.	9:00 P. M.
On Saturdays	
7:10 P. M.	9:00 P. M.

Average miles per hour including deliveries, 11.8.

Another month's record, in this case applying to delivery by means of a motor cycle with carrier attachment in the service of Charles A. Stevens & Bro., the well-known Chicago silk merchants, is furnished by the Fowler-Manson-Sherman Cycle Mfg. Co., the makers of the motorcycle carrier. It reads as follows:

Date	Numb'r of trips	Time Delivering	Number of Packages	Number of Miles
Dec. 6	3	4h 15m	132	29
" 7	3	4h 45m	78	21
" 8	3	4h 30m	87	27
" 9	4	5h 30m	116	31
" 12	4	6h 30m	157	38
" 13	3	5h	96	27
" 14	3	5h	91	28
" 15	3	4h 45m	113	28
" 16	5	5h 45m	105	35
" 18	2	3h	69	21
" 19	4	4h 30m	82	35
" 20	3	5h 30m	121	41
" 21	1	1h 30m	15	18
" 22	3	4h	81	26
" 23	4	3h 30m	58	30
" 26	2	2h	25	17
" 27	3	4h	54	23
" 28	2	3h	47	18
" 29	2	4h	50	29
" 30	4	6h 30m	99	68
Jan. 2	1	3h	56	15
" 3	4	7h 30m	123	31
" 4	3	5h 30m	131	30
" 5	3	8h	158	29
" 6	4	7h 15m	129	31
Total 25ds.	75	118h 45m	2273	727

The averages in this month's performance are: 91 packages delivered per day on three daily trips of an average distance of 9 2-3 miles per trip. The cost for gasoline is given as 10 cents per day.



GASOLINE TRUCK BUILT BY MATHESON COMPANY OF WILKES-BARRE, PA.

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Traffic by Motor Power in Europe

MAINLY A DIGEST OF THE BRITISH AND CONTINENTAL TECHNICAL AND CLASS PRESS

OMNIBUS MATTERS DISCUSSED

British Engineers and Traffic Managers Give Some of Their Experience

WITH all indications pointing to a great demand for motor omnibuses and stages in this country, those who listen to the songs of the promoters of public service projects based upon the possibilities of the motor vehicle, enjoy the advantage of being able to draw some information from the experience accumulated in England during the past one and one-half years. This experience is now cropping out in the numerous discussions before clubs and other associations of Great Britain on the subject of motor omnibus traffic, discussions in which those best able to judge, either from the engineering standpoint or as business managers or even as promoters, take active part. Extracts of remarks made by various representative men of these classes are represented in the following:

Buses Face Their Duties

"It was shown that the motor omnibus could come out every day and face its duties like any other commercial enterprise, and it was shown that it could be kept going on the road without breaking down."

Remarkable Mileage

"A few of the vehicles had done most remarkable performances with an endurance that was not to be expected. What would be thought of thirty-one to thirty-two thousand miles per annum? That mileage had been reached by a few of the vehicles."

Strains From Gear Changes

"Change of gear must go. Change of gear was responsible for a great deal of the wear and tear of vehicles, which developed itself in clatter and noise. It was impossible to always get a man who had the knack of changing gear at the right moment. Moreover, in public service vehicles the conditions were very different from those which obtained on private vehicles. He alluded to double-decked 'buses and the tremendous top load which they carried. The driver, in changing gear, usually changed badly; the vehicle almost stopped, and down came the chassis just underneath the driver's feet, and very nearly snapped. The strain thus put on the parts was extraordinary, and one which it was never intended that the vehicle should bear. It was entirely due to want of skill on the part of the driver. There would not be much improvement until drivers were trained to their work when young. If the change gear was absent, the front part of the chassis might be made twenty per cent lighter than it was at present, and still retain the same amount of durability."

Drivers From the Young

"Motor 'bus companies were in a very difficult position just now. They were obliged to train men who knew London, and those were the men who drove the horse 'buses. They knew the routes. The motor 'bus companies took these men at a mature age, and had to do their best with them. He thought they had done very well indeed under the circumstances, but there would not be this trouble in the future, when it would be possible to train up the cleaner and the boy in the yard to become drivers, and to initiate them into the mechanism of the car before being allowed to take one out upon the road. In this they would be following on the same lines as those adopted on the railways in regard to the training of engine drivers, where they promoted the boys and cleaners in the running shed to be stokers, firemen and so on, to the rank of goods drivers, and then express drivers. The way to learn how to drive a car was to learn how to clean it first, and how the parts were kept in order, what parts required attention, and so on. Youths of seventeen or eighteen, who had passed through this cleaning experience, would by the time they reached twenty become expert drivers, very much superior to the drivers of the present time. He believed a very good move had been recently made in this direction by the London polytechnics, which had opened schools for teaching boys and young men, and old men, too, for the matter of that, the mysteries of motor car construction. These polytechnic classes would be found very valuable to youths who contemplated becoming drivers. The necessary training would take no more than a year or a couple of years, and by that time, when these more or less properly-trained men came upon the scene, the cost of repairs and maintenance of public service vehicles would begin to diminish very rapidly."

Manager's Experience

The first condition requisite in a motor 'bus for London was to have all the parts absolutely accessible, especially as regarded the engine and gear box. In that business more than in anything else time was money, and as a responsible manager he realized that each time one of his 'buses stopped in the yard it was money lost to the company. He must, of course, arrange his work to have the 'buses running as long as possible every day, doing the maximum number of journeys, and stopping as little as possible in the streets. One gentleman had suggested that work should only be done on the 'buses in the way of repairs, etc., during the day, but in public service work at the present time that was impossible. All the big companies in London had only a comparatively small number of 'buses. The competition was so keen that if they had only fifty 'buses they must try and keep them all running every day. They could not spare a single 'bus to be off the road. Perhaps later on, when they had two or three hundred, they might be able to do differently, but until then they must go quickly and make the most of what they had in order to meet the competition. A big question was that of the repairs to 'buses, and he thought it would be best always to try to replace any damaged parts by new ones, rather than try to repair them, but in order to do this it would be necessary to have a large number of spare parts in stock, so that directly a disabled car came in any broken part could be replaced immediately by a special staff of workmen. Another matter which caused trouble was the gears. Personally, he did not think they could suppress gears unless they had an electric transmission. In regard to the pneumatic tire, he did not think, judging from his experience with private cars, that the pneumatic tire could resist the weight of the 'bus and the stresses which the 'bus had to absorb all the time in starting and stopping. That was one of the things that must be considered in connection with pneumatic tires—the lateral strain on the different parts of the tire. He thought the best tires were those made with canvas, but in the course of a very few months the wear completely destroyed the canvas. On the question of drivers he had quite a different opinion from that held by some others. The drivers he used were all old horse 'bus drivers. They know absolutely nothing about the mechanism of the vehicles they drove, and he did not want them to know anything. They were able to run the 'buses on an average 120 miles a day. He, of course, had a certain system of organization by which a number of men were kept on the road within easy distance of any 'bus in case of emergency, who were able to put it right without the driver touching or interfering with it. His experience was that some of the most mechanically inexperienced men of the company made the best drivers. They always made full journeys and never touched the mechanism of their cars.

Economical Repairs

"Until the parts of the motor car were sufficiently standardised, repairs would never be made economically. When standardisation came about they would be able, instead of repairing any particular part, to renew it. On the one hand they had to look for progress, necessitating alterations in design, and this was naturally a hindrance to standardisation which could not be properly introduced until some finality in design was reached. They must first hurry on their design and get that right generally, as quickly as possible; then they must as quickly as possible standardise the parts, or many of the parts, which at present were all of different dimensions."

The Spare Parts Supply

"They spoke of works management and business management as two separate and distinct things, but the mechanic of today, if he was to understand the management, whether of works or public service depot, must have some rudiments of business ability in the way of organizing his department. He believed many 'buses were standing still today simply because the managers omitted to get spare parts in time, or else because the makers of the 'buses neglected to supply those spare parts."

Who Should Design

"It would be a good thing if all who had responsibilities in this matter of design could spend a month as fitters in one of the running sheds in London, and let it be a stipulation that the man who was not capable of keeping his job as a fitter should not be allowed to design a motor 'bus; they might then get some good design."

Engines Give No Trouble

"The engine is the easiest part of motor omnibus design."

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INFORMATION FOR BUYERS

MANUFACTURE STARTED.—About one-half year ago the Matheson Motor Company, of Holyoke, Mass., secured a new factory at Wilkes-Barre, Pa., especially for the production of commercial motor vehicles. The first vehicle turned out at this factory has now been finished and shipped to New York.

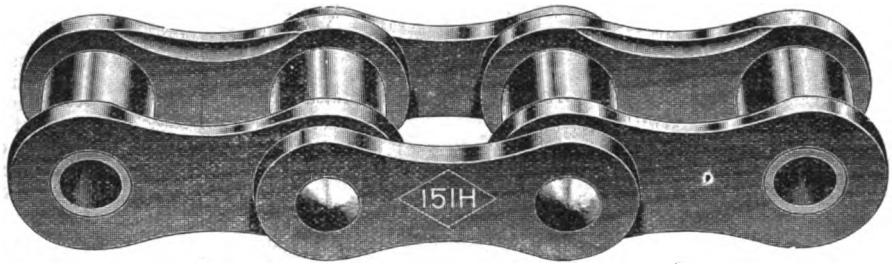
NEW LAMP FACTORY.—The Standard Lamp Co., of Chicago, will remove to Charlotte, Mich., where it will erect a large plant to be used exclusively for the manufacture of motor vehicle lamps. The main building will be 178x40 feet, another will be 100x40 feet; both will be ready for occupancy August 1.

FIRST IN BUCYRUS, OHIO.—The Climax Automobile Co., of Sandusky, Ohio, has sold the first motor delivery wagon to be used in Bucyrus, Ohio, through Rosino Bros., the manufacturers' agents in that town. It will be used by William Roecker in the delivery of bakery goods.

CIRCUS VEHICLES. — The Barnum & Bailey circus has recently been negotiating with the Rapid Motor Vehicle Company, of Pontiac, Mich., for the manufacture of trucks adapted for the transportation of wild animals on a plan similar to the one adopted by the Carl Hagenbeck wild animal show, of Europe, the trucks being equipped with two sets of wheels, one flanged to run on railways, and the other fitted with rubber tires and used for transportation over ordinary roads and in street parades.

Pressed Steel Truck Frames
The
PARISH & BINGHAM CO.
CLEVELAND, OHIO

CHAIN TRANSMISSION



THE MOST EFFICIENT, ECONOMICAL, POSITIVE AND FLEXIBLE METHOD LENGTHENS THE LIFE OF THE ENGINE—CONSUMES LESS POWER

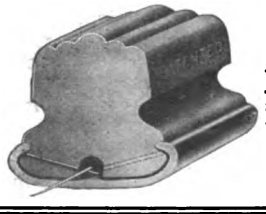
¶Write for our book "Standard Dimensions of Power Chains and Sprockets," giving our method of designing and cutting sprockets, and other valuable data.
¶"DIAMOND" Chains Have Nickel Steel Rivets and Reamed Holes.

Diamond Chain & Manufacturing Co.
243 W. Georgia St., INDIANAPOLIS, IND.

Keep Track of Mileage and Speed

It is fully as important to register the distance traversed by a power wagon as it is to have a record of the fuel or electricity consumed, or the quantity of lubricant used. The mileage of the vehicle is most accurately registered by a *VEEDER ODOMETER*. If a record of both speed and mileage is required the employment of a *VEEDER TACHODOMETER* becomes imperative. Descriptive literature of these instruments sent upon request.

Veeder Mfg. Co., Hartford, Conn.



SWINEHART
MOTOR TRUCK TIRES

Not only the best, but absolutely perfect. Fastening positively secure. No retaining wire exposed to the road, sand, water and rust which is the destruction of other truck tires, but perfectly enclosed in the clincher rim. Soft and resilient and never fail under a big load.

THE SWINEHART CLINCHER TIRE & RUBBER CO.
AKRON, OIHO, U. S. A.

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Tom Johnson on Motor Buses

Cleveland's Automobile-loving Mayor Shies at Omnibuses and Doubts Power Wagon Economy

AMONG all the mayors of American cities of the first class Hon. Tom Johnson of Cleveland might be supposed to have studied the subject of motor omnibuses most deeply, since he is not only a mayor but also a street railway magnate, and not only both of these but also an aggressive advocate and user of motor vehicles.

It was indeed supposed that he could give his interviewer and the public more information about the financial aspects of motor omnibus traffic in London, Berlin and Paris and of the financial chances of motor omnibuses in American cities, than the interiewer could impart, and with the object of placing such valuable information at the public's disposal at this moment, while attention is focused upon the possibilities of motor vehicles for public transportation service, an interview was sought.

Probably "Mayor Tom's" secretary had failed to specify the purpose of the call, for when it was stated, the sharp little nose in the mayor's broad rustic face hooked itself a little sharper, the nostrils were drawn tight and stubborn wrinkles formed around the thinned hard-set lips. The eyes shone hostile but true, revealing the dual nature of the man.

"The possibilities of motor omnibuses for American cities."

"The use of power wagons for municipal work, especially that of the street cleaning department."

Was there anything in these subjects to cause uneasiness? Apparently there was, though that such might be the case had not been foreseen. The face said plainly: "You want me to commit myself. Well, try it." The mouth said: "How much time do you want?"

"Ten minutes."

"Too long, I have not ten minutes to spare."

Within one-half minute it became evident that Mayor Johnson was an automobilist but not an advocate of power wagons and particularly shy on the omnibus question. Automobiles in the lighter sense are all right as a topic for discussion. And for ambulances; certainly. But omnibuses, limitation of street railway franchises, sidelights on municipal ownership! No, that is forbidden ground. It would be very easy to say something which might clash with political or property interests.

"Would motor omnibuses, now that they had been proved practical and profitable in London, affect the policy of American cities as to the granting of franchises for laying rails in the outlying districts?"

"Motor omnibuses will never pay here," was Mayor Johnson's opinion. "It is different in London. There they compete with a bad street car system; here, with a good one. I don't believe you can run them for seven cents per passenger."

"They figure in London that they can run them for 20 cents per car mile, and that they should pay better than street railways wherever the traffic does not warrant cars to run closer together than every six to ten minutes, and they expect to get the expenses down a good deal lower."

"They would pay best down town, but they would not pay there," insisted the mayor.

It seemed difficult to get away from the idea of competition with street railways, though it had not been broached. That the omnibuses might be made auxiliary to street railways in residential districts, where a certain prejudice against rails exists, had apparently never occurred to Mr. Johnson.

"Anybody who thinks he can operate buses against street cars can come and try it. Franchises? They need no franchise." This was intended as an answer to the question about new franchises for street railway companies.

A reference to the municipal ownership question in Chicago and the possible adoption of motor omnibuses in connection with it, though not intended as a thrust, was parried by a remark to a bystander and a counter question, while a direct question about the use of power trucks by the city of Cleveland was referred to the street commissioner; and the interviewer was compelled to admit that the result of Mayor Johnson's studies of power wagon

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economics were unavailable as a source of information for the public at present, and that his interest in the question had probably not yet been awakened.

The situation seemed to indicate that the initiative for introducing power wagons into municipal work must come from designers and manufacturers and cannot be hoped for on the part of city officials, even the most progressive, who are not compelled by competitive business considerations to be on the lookout for sharp economy in transportation work. Perhaps it also indicated that familiarity with automobiles is more of a hindrance than of help for realizing the saving and convenience which power wagons, properly maintained and operated, place at the disposal of the business world.

Future of Sales Agencies

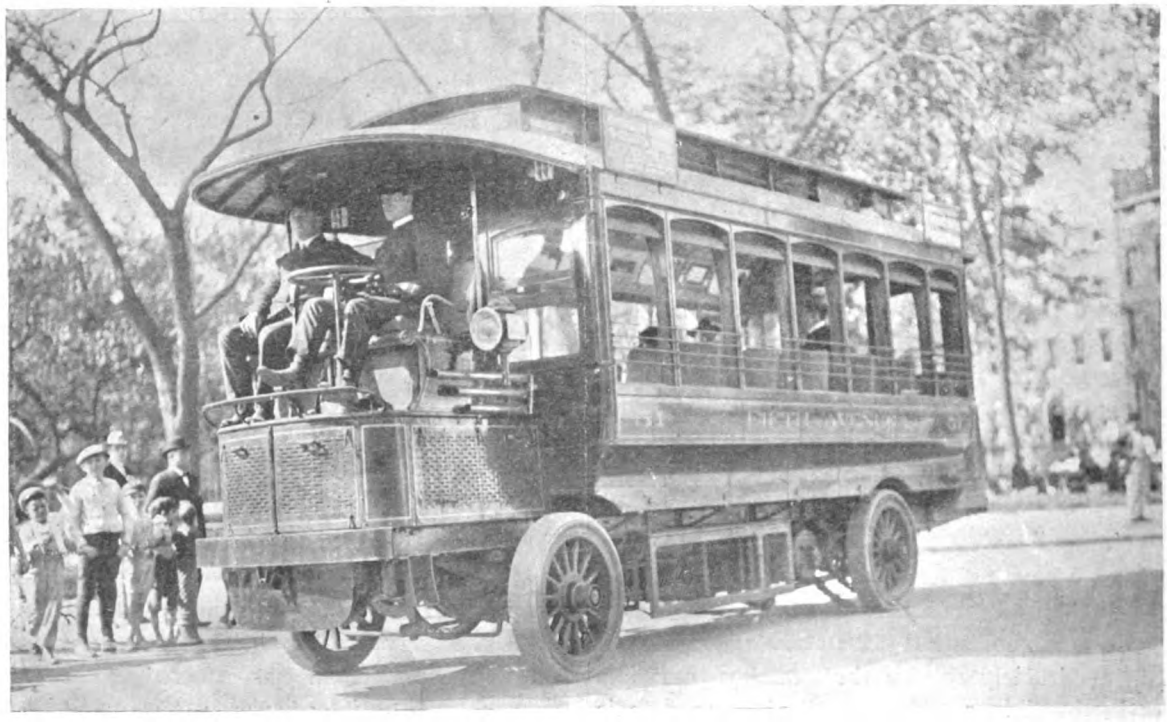
THERE is no denying that the majority of automobile dealers are unfamiliar with the best methods of selling commercial motor vehicles and unable, as well as unwilling, for the commissions offered them, to study the requirements of possible customers for this class of vehicles or to take care of their interests after a sale has been made to them. Manufacturers on the other hand, realize that they cannot afford to continue dealing directly with power wagon users, if each sale is to involve so much educational work as it does now.

The purchaser of power wagons, finally, feels that he is entitled to all kinds of help for enabling him to derive a profit from his investment and understands fully that his endorsement of a vehicle is worth all he asks of the seller in the way of advice, liberality and subsequent assistance in maintenance troubles. So long as names and reputations have not yet been firmly established in this line, and so long as the methods for geting the best out of power wagons that there is in them, have not become generally understood, the demands upon the seller, whether manufacturer or agent, will remain exacting and out of all proportion to the seller's profits and facilities.

Apparently there is room for business organizations in which the facilities for both making and protecting sales may be systematized, for the relief of manufacturers and the benefit of the purchasers. Undoubtedly it happens frequently that a merchant after buying a vehicle discovers that he should have bought one of different size or type. An exchange with another merchant might be desirable for both. But the expert intermediator is lacking, and nothing is done.

Considering that the abilities of a good power wagon salesman must be more versatile than even those of an insurance adjuster, and must include a very fair knowledge of mechanical engineering coupled with talent for organization, it would be unreasonable to expect that the number of successful agencies could rapidly become sufficiently large for coping with the demand for their services, and it seems therefore at present most probable that the difficulties of the situation will be solved by the rapid expansion of the business connections of a few dealers who are now showing exceptional aptitude for the work.

The opening for building up business organizations of this nature, which may eventually reach great magnitude from a small beginning, is unmistakable, and should stimulate those who feel the calling to an energetic effort at mastering the subject.



EXPERIMENTAL GASOLINE MOTOR OMNIBUS WITH ELECTRIC DRIVE ON FIFTH AVENUE, NEW YORK

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Auxiliary Cushion Devices

Beginning of Engineering Movement to Render Portable Machinery As Durable As Stationary

AFTER practically completing the work of producing several types of motor and vehicle mechanisms which will do all kinds of transportation work, the automobile engineering world is now deeply engaged in the no less absorbing task of protecting these structures of comparatively new creation against the effects of their own superabundant motive energy. In other words, the engineering world is facing the problem of making auto-portable structures of great speed possibilities as lasting and durable as stationary machinery. Of course, the question of durability and strength to resist road shocks was never forgotten. It has always insisted upon consideration. The whole racing movement in the automobile evolution had only this question for an excuse, from the economical standpoint. But, until other more fundamental problems relating to reliability of the operation of the power plant had been solved, the almost preposterous ambition for imparting as long life to machinery constantly jolted about as no machinery ever was jolted and shocked before in the whole history of machine construction and machine work as it is possible to obtain from stationary machines or marine machinery, which may be built with almost any required weight of material and parts, was not the first and foremost consideration.

The proper balancing of motors, their mounting in the vehicles with a view to escaping vibration, the use of soft, elastic tires, the improvements in vehicle springs—were all factors in construction designed to reduce the intensity of shocks and thereby lengthen the life of the structures, but it is only during the past two years that the possibility has been realized of keeping all shocks so far within the elastic limits of all materials employed as to reduce the effect of the constant repetition of the shocks to a matter of no more consequence than in a bridge structure for example. More or less consciously the efforts of designers are now mostly turned toward that ideal, and what has turned them is partly the perfection reached in other features and partly the considerations of high economy in the commercial work of motor vehicles.

No rest will be given the problem, from present indications, until all parts of power wagons not subject to direct wear will last indefinitely and all the wearable parts—the bearings, in the broadest sense of this term—will last as long as in a stationary steam engine.

The problem is attacked from both sides. Steel makers and designers combine to find the alloys whose strength and elastic limits, with reasonably small dimensions, will be beyond reach by road shocks, so as to permit the smallest possible amount of material, consistent with the function of each machine part, to be used—avoiding the "dead weights" of massive parts which pound themselves and all upon which they are supported— and, on the other hand, the makers of tires, of springs, of special spring devices as well as designers of frames and suspension systems strain their ingenuity for preventing all shocks from reaching any one spot in the vehicle and engine structures until they have been toned down to such reduced intensities as can do no harm, either at once or by constant repetition.

It is difficult to gauge exactly the present economical importance of these efforts. Some day, however, they will all be rounded up in an acknowledged standard system of construction whose adoption will mean an 80 per cent reduction in the cost of maintenance for all automobiles and power wagons used in accordance with the intentions of their designers and makers, just as progress in other directions has already resulted in an 80 per cent reduction of operative troubles.

The part played by tires in protecting machinery has been the subject for previous extensive mention in this publication, and further reference to their importance in this respect, may here be omitted. The tires themselves, however, need protection, as they are not the cheapest substance which may be employed for absorbing shocks. Tires and springs mutually protect one the other, and both protect frame, motor, gearing and load. Any suitable additional elastic factor will help tires and springs to do their work and in so doing will incidentally protect the tires and vehicle springs, too, thereby reducing their cost of maintenance.

The object is to absorb as much of the road shocks as possible in the cheapest, strongest and most economical by replaceable device.

Some of the devices intended to fill this place in motor vehicle construction may be described.

SAGER EQUALIZING SPRINGS

A simple coil spring of the barrel pattern with an eye at each end! That's all.

One end is fastened to the axle or other convenient part of the running gear, while the other end is fastened to the body or upper frame work.

In railway car trucks it has long been recognized as a necessity to combine the leaf spring action with the spiral spring action in order to combine a minimum of vertical play with a maximum of shock-absorption. It is this principle which is now being extended to motor vehicles plying on common roads, where its application is more urgently needed. An incidental but perhaps important advantage of the combination is that the weaker leaf springs which it admits afford some yielding and cushioning against lateral stresses, which leaf springs strong enough in themselves to sustain the load under all road conditions do not afford.

These remarks apply to some of the other auxiliary spring devices as well as to the Sager, but not to all.

The special qualities of the latter are expressed by

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its maker in communications from which the following is taken:

The barrel spring has one decided advantage over other types of coil springs, namely, that it admits of easy action within a certain limit, or at the point where circle of spring is largest. The small coils at each end are much stiffer and come into play only when needed, at a time when an overload is applied or a violent rebound occurs.

Therefore the action of the leaf springs are easily and mildly checked in either direction.

The Sager Equalizing Spring is so designed and placed that it acts in the capacity of both a compression and tension spring, changing automatically with the up and down movement of the body of the car.

In other words it is simply a spring governor placed between the body and running gear, keeping elliptic and semi-elliptic springs in their normal position and enabling them to always do their work under all conditions without destroying their resiliency and efficiency.

It does not destroy the riding qualities of a vehicle over good roads in order to correct its bad qualities over bad roads.

The Logan Construction Co., have adopted this device as regular equipment on all their trucks both light and heavy, which is also true of the Olds Motor Works. By actual competitive test it has been found to be the only device that will carry a two ton load with safety, without bending axles, breaking springs, and otherwise disarranging the transmission gear and other machinery.

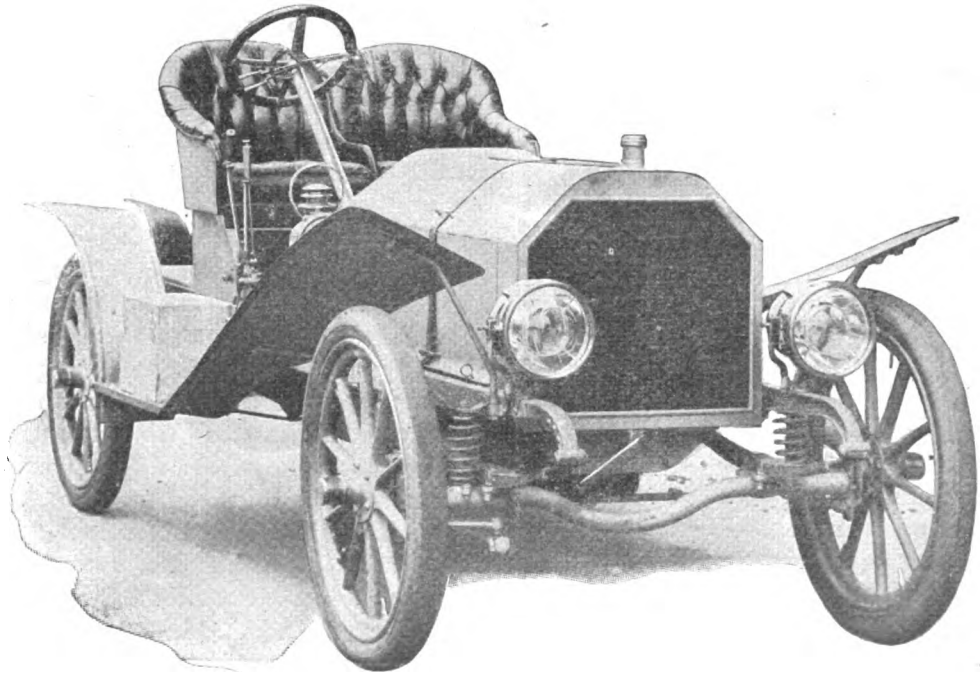
To illustrate we made an exhaustive test at the Olds Motor Works, at Lansing, Mich. At the time of the writer's visit at their factory, they were testing one of their big trucks with two tons of pig iron as a load, and to use their own expression were "doing fool stunts," in order to put the car out of business, realizing that this would occur when the cars were put in general service. This particular car had a speed of over twenty miles per hour, was equipped with solid rubber tires, had large rubber bumpers between the springs, and very heavy strap checks to catch the recoil. In spite of these, in carrying this load at the above speed over extremely rough places, the I-beam axles 2x3 inch would bend out of shape, the flat springs would break, the chains would break, and gears strip, and in fact the whole car was practically put out of business.

After we had removed the straps and rubber bumpers, and applied the Sager Equalizing Springs, which, in this case, were made of 1-2 inch rod, crucible spring steel, 10 inches in length over all, and 4 inches outside diameter, we found that we could not only carry this load over the same road at the same speed with perfect safety, but were also able to carry eight men on top of the load. As a result the Olds people held shipment of these cars for weeks awaiting shipment of these springs, deeming it unsafe to allow them to go out without them.

In the Logan case, we found they were having so much trouble with broken springs, because of the users of cars subjecting them to over-loading, and driving at full speed over rough places taking no precaution whatever,—that they had equipped their cars with tremendously heavy flat springs, resulting in practically no spring action with light loads. This, of course, would result in excessive vibration, unless the car was very heavily loaded, and would materially lessen the life of the car. We induced them to equip their cars with much lighter flat springs, and in connection with these lighter springs use our Equalizer, with the result that the car rides well with either light or heavy loads, and will carry even a heavier load than when the excessively heavy flat springs only were employed.

The reason for this is obvious. The flat elliptic springs are slow in action, while the Equalizing coil springs are just the opposite, viz., quick in action, multiplying in stiffness the farther they are compressed or extended. These Equalizing coil springs are designed to be placed on the car in a neutral position, i. e. neither compressed or extended when the approximate load is in the car, thereby being free to work up and down past the neutral point, and are easy in action within certain limits, producing an easy riding car with light loads. On the other hand when subjected to heavy loads, the coils multiply in stiffness according to the load, sustaining it before the axles are bumped, at the same time checking the recoil, after the neutral position has been passed, preventing tossing and the breaking of flat springs.

The device, we find, is attracting a great deal of attention among the manufacturers, dealers and users of every description, all the way from light runabouts to heavy trucks, and will unquestionably do the work requested of it, if properly proportioned to the job, and with the flat springs. Our experience has been that much more elastic flat springs can be employed, giving a



SAGER EQUALIZING SPRINGS APPLIED TO SEMI-ELLIPTIC FRONT SPRINGS

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greater range of action without bumping or tossing, permitting of a much greater load with safety, and of much greater speed over rough roads, and at the same time does not destroy the resiliency over fairly good roads.

GRAHAM COMPANY'S TWO SYSTEMS

The Graham Company of 84 Waumbeck street, Boston, copyrighted the name "Supplementary Spiral Springs" in 1893, so that it may be inferred that the appreciation of their necessity had nothing to do with the high speeds of motor vehicles. The arrangement of the supplementary spiral springs consists simply in the addition to the leaf springs of two connected spiral springs in the form of a hanger in the manner shown in the accompanying illustration and equally applicable to full-elliptic springs. Says the patentee, John Hector Graham, with regard to the principle of spiral auxiliaries:

The principle involved with the spirals is to start them at a low initial tension and as they are loaded they increase in capacity until they are drawing on the leaf, i. e., if we should design a spiral to start in at 60 pounds it would close up, in a movement of one and a half inches, at 400 pounds. Double this at the end of the leaf and you have 800 pounds, which will start the stiffest leaf spring now used on any automobile. We, therefore, have all the varying resistances from 60 to 400. The spirals are tensioned to the leaf, and when the wheel rises over an obstruction, not being able to throw the load up, they are compressed, and the instant the wheel drops they expand and absorb the rise, keeping the car body in an even plane and eliminating entirely all the vibrations.

The relations between supplementary springs and tire cost are not ineptly put by this firm, though the style is that of an advertisement and one important quality of the pneumatic tire is ignored in the statement. It reads as follows:

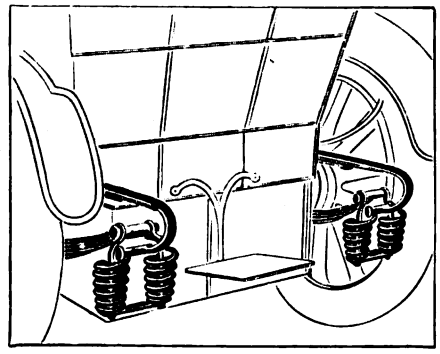
A pneumatic tire is just a sensitive spring. Its compressed air cushion responds to a thousand minor vibrations that never reach the steel carriage springs. And every vibration is a bounce, in miniature. There are just so many bounces in the life of the pneumatic tire. You may, therefore figure tire-cost at so much per bounce. And, that cost is tremendously high when compared with the cost, per bounce, of spring steel. But, the regular steel springs on motor-cars are too stiff to do the work of pneumatic tires. Because these steel springs must be made strong enough to receive the hardest shocks, with the heaviest loads. Thus they cannot be made light enough—sensitive enough—to relieve the tires of the million minor bounces per hour. And so, the pneumatic tires must do 90 per cent of the springing. That's why they wear out, and are such an expensive item in the year's running.

That's why the Graham supplementary spiral springs were invented and patented.

Each of the four supplementary springs is really two springs in one, or eight springs on each carriage. These spiral springs are so sensitive that they respond even quicker than the tires to slight vibrations and minor shocks. They thus do most of the "spring" work before the pneumatic tires can do it. In this way they relieve the tires of about two-thirds the bouncing that wears them out.

When running over rough roads, or with heavy loads, the sensitive spiral springs receive the support of the leaf springs every time the car bounces over a railway track, or over a "thank-ye-mum." These auxiliary springs then come into action only when needed relieving the tires of their severest work and their most destructive strain. Consider what these supplementary springs mean to the life of the motor, as well as to the wear of the tires.

It may be worth noting that the pneumatic is not "just a sensitive spring." Being rotary, it has the peculiar quality that the recoil is distributed all around the wheel, neutralizing itself in a radial pressure against the whole circumference of the inner tire wall, whenever the wheel is revolved so rapidly that the reaction of the compressed air does not get time to take effect before a new portion

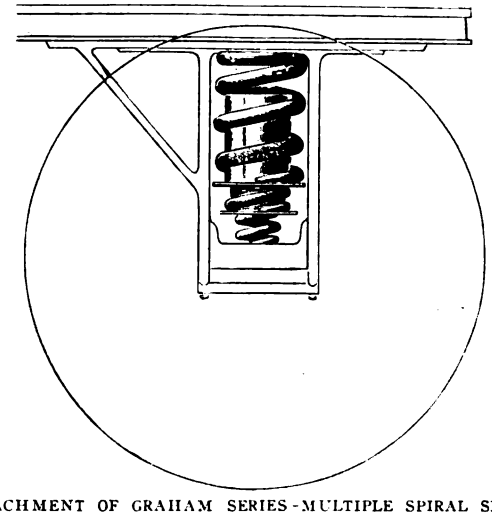


SUPPLEMENTARY SPRINGS APPLIED TO SEMI-ELLIPTIC VEHICLE SPRINGS

of the tire tread is in contact with the ground and supporting the weight of the vehicle. This is the peculiarity of elastic tires which renders them specially valuable for any form of transportation rapid enough to bring the quality into effect, and it is also this peculiarity which makes a pneumatic tire so much more effective under a heavy load than under a light one, because under the light load the reaction of the compressed air is so much more rapid that the vehicle at any reasonable speed cannot get away from the recoil at the ground contact. It is finally the same quality of recoil-absorption, which the designers of "shock absorbers," whether of the friction type, the pneumatic check type or the equalized-spring type are endeavoring to incorporate in the combination of vehicle leaf springs and the "shock absorber."

The omission of this quality from consideration in the Graham company's argument does not essentially affect the reasoning, however.

The Graham company goes farther than providing an attachment to leaf springs. Besides a spiral spring



ATTACHMENT OF GRAHAM SERIES-MULTIPLE SPIRAL SPRINGS

bumper its inventive spirit has designed multiple spiral springs intended to take the place of leaf springs entirely in all kinds of vehicles. Their design and attachment is shown in accompanying illustrations. They are called

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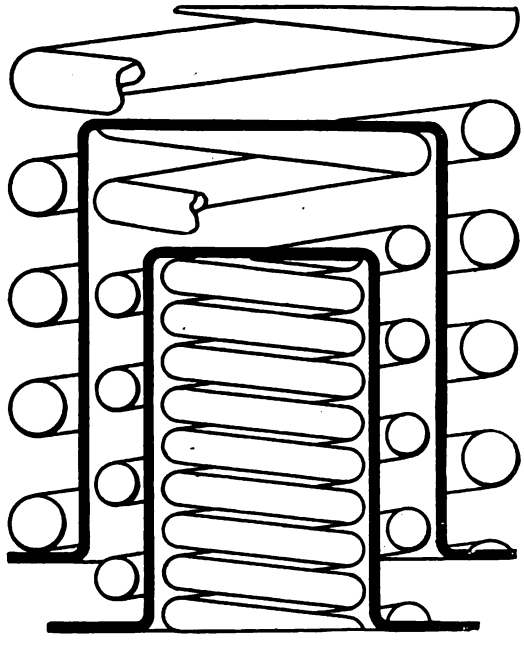
Series-Multiple Spirals, because the heavier springs are not called into action before the resiliency of the weaker springs has been exhausted. Thus the empty wagon rides on the light springs and the loaded wagon on the light plus the heavier springs. With their substitution for leaf springs there is a saving of 80 per cent of the weight



DESIGN OF GRAHAM SERIES-MULTIPLE SPIRAL SPRINGS

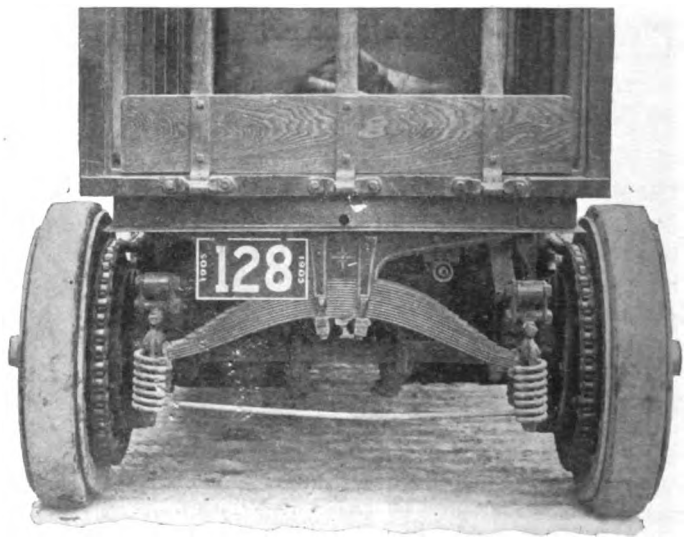
of the latter, but, unlike most of the merely auxiliary cushion and safety devices, the Series-Multiple springs can ordinarily only be fitted to new vehicles. In connection with the main subject under discussion in this article it seems appropriate to note that the suspension of the vehicle axle free to move in the vertical slots of the rigid brackets connecting it with the vehicle frame, apparently does not provide any possibility for lateral cushioning, unless some special provision, not mentioned by the manufacturer, is made to that effect. There may also be complications with the driving system of power wagons presenting problem to be overcome by special means in each case. In these respects the series-multiple spiral spring system does not seem to have been worked out as yet with special reference to power wagon requirements, though it is probably capable of extension in that direction.

ST. LOUIS SUPPLEMENTARY SPRINGS

The identical principle embodied in the Graham Company's supplementary spiral springs is represented with some variations in the products of the Supplementary Spiral Spring Company of St. Louis. A distinction between the "Equalizer" type and the "Supplementary" type of auxiliary springs may here be noted, by the way. One makes a light vehicle spring perform properly for a heavy load; the other makes a heavy vehicle spring acceptable for a light load. Both may be normally either under compression or under tension. Still the "Equalizer" type *may* be so proportioned and mounted as to be under tension when the load is too light for the spring and under compression when the load is excessive. Its principle is therefore somewhat the more broadly adaptable of the two, besides making for reduced weights; but the "Supplementary," on the other hand, requires perhaps less insight for the adaptation to each vehicle.

Owing largely to the rough pavements of St. Louis, the device made in that city has been applied, in its various forms, to a large number of the power wagons operated there. An accompanying illustration shows it applied to the platform springs of an Anheuser-Busch electric beer wagon. It is stated that electric batteries yield additional mileage per charge when the supplementary springs are used, by reason of the reduced vibration. Adams Express trucks in New York City are fitted with them, also some Packard trucks and many rapid delivery wagons and some Cadillac delivery wagons.

As usual when something new is working up in motor vehicle construction there is war in the air between the factions among the improvers, all bent upon benefiting the public, but each convinced that the benefit cannot be conferred except by the universal adoption of the particular device in which he believes. And usually the reasoning advanced by each faction is so plausible that only a bold man would judge between them on any other basis than that of experience. They all contribute, however, to stimulating that reasoning upon the subject among the users of power wagons and automobiles, which is necessary before the adoption of any of the devices can become universal. And in this manner they are all working together for the common good.



SUPPLEMENTARY SPRINGS ON ST. LOUIS BEER TRUCK

The elasticity of air more or less confined is the quality which has drawn a school of improvers to air cushion devices. Others operate with confined liquids, getting the effects desired by the varying degrees of friction developed in liquids accordingly as they are forced through a large or small opening. Simple mechanical friction of leather or fibre against metal, or metal against metal, is the element employed in the original "shock-absorbing" device and by those to whom that method, in its variations, most appeals.

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It will be noticed that by some of the improvers it is taken for granted that the vehicle leaf springs may be so proportioned that they will act right under varying loads, so far as their downstroke is concerned, while requiring remedial interference with their recoil, and that others believe the total leaf spring action to be faulty, so as to require auxiliary action for both downstroke and recoil.

AIR CUSHION DEVICES

The Kilgore Automobile Air Cushion Company, 46 Columbus avenue, Boston, set forth that "it is the unrestrained downward plunge which weakens and flattens the springs permanently." They use an air-tight phosphor bronze cylinder with suitable by-passes arranged in the walls to regulate the movement of the air back and forth from one side of the piston to the other. As may be seen in the accompanying illustration the piston is fitted with piston rings. Grooves are milled in the walls of the cylinder; of equal length but commencing and ending at different points. The groove coming nearest the top is cut 7/8 inches from the under side of the cylinder head while the groove going the farthest down comes within 1 1/8 inches of the bottom of the cylinder.

The piston on good roads plays in a position where all of the grooves are used for the air to pass back and forth and are of sufficient capacity, so that there is no restraint on the piston, or upon the springs. As the piston moves beyond this normal play it passes beyond one, two, three, or more of the grooves, thereby contracting the air passage space and acting through the piston on the springs, preventing their too violent play. Finally, when the upper or lower groove is covered by the piston, the elastic cushion of air is met, and further motion up or down, as the case may be, is prevented by this elastic air cushion.

The device, as will be understood from the description, is a safety appliance for very flexible springs, primarily designed for high speed automobiles and not for reducing vibration in power wagons running empty on springs calculated for heavy loads. It is in accordance herewith when the manufacturers term their device a "shock-eliminator for automobile uses." They say on this subject:

"We have never applied our device to Power Wagons, but stand ready at any time to co-operate with any reliable manufacturer in adapting the Kilgore device to the particular needs of his wagon. We have applied them, however, to a great many of the heavy touring cars, which as you know, are loaded to the limit with passengers with baggage, and driven at a high rate of speed over all sorts of roads. Customers who have used them in this way are delighted with the saving to the car and its added comfort to themselves."

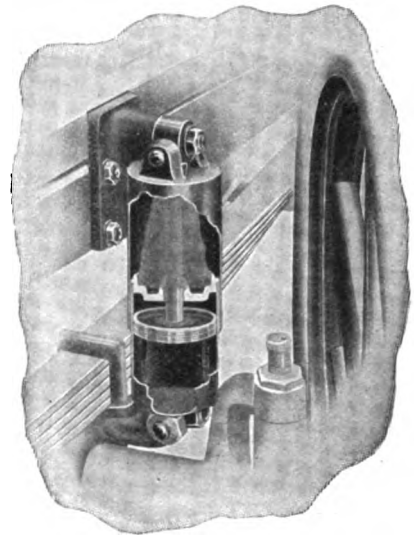
The principles embodied in the device is expressed by them as follows:

No restraint on the natural easy action of the springs in either direction on the ordinary good pavement and dirt roads.

An automatic restraint on the too violent up and down spring play in the exact amount made necessary in each individual case.

An easy positive stop to prevent the springs going so far in either direction as to run the risk of bumping the axles or of spring breaking or distortion (flattening).

So constructed as to permit the use of springs of such flexibility as to relieve the tires from lifting bodily the load of car and passengers or merchandise over every unyielding obstuction met with on the road. They must also act as an equalizer of the load on the springs by automatically taking the extra load and strain which would naturally come on the springs, in other words, causing the springs to carry their normal load at all times regardless of the road conditions.



THE KILGORE AUTOMOBILE AIR CUSHION

In other pneumatic appliances, such as that made by the Sheddan Manufacturing Company, 140 Fayette street, Baltimore, the action aimed at is based upon similar considerations. "It permits," say the Sheddan people, "of the use of lighter and more flexible springs;" the special requirements for heavy power wagons are not in the foreground, though of course the reduction of shocks and vibration in case of violent shocks is of the same economical value in the use of power wagons as with regard to touring cars.

A little of the war between cushion devices is vented in one of the Kilgore circulars, and as the ventilation of it is instructive, with particular reference to the needs in commercial transportation service, some passages from it may be copied as follows:

Why does a man strap rubber bumpers to the axles of his automobile?——To prevent the body and frame from bumping the axles.

Why does a man have the frame and axles of his automobile fastened together with heavy leather straps?——To prevent the breakage of his auto springs by a too violent rebound.

Why does a man have coiled springs hung all around between the frame and flat, or regular springs of his automobile? ——To counteract the stiffness of the regular and necessary springs, and make his automobile ride easier on rough going.

Why does a man have revolving friction plates attached to the axles and frame of his car and between the frame and springs?——To attempt to prevent a too sudden downward movement when bumps and holes are met with in the road and the too sudden rebound of the stiff springs afterwards.

Now it is evident to the thinking man, that

1st. The rubber bumpers and straps, while they may protect the axles and springs of the automobile, do not protect the bodies of the passengers [mechanism and load] from the shock of the rough roads, and what is even more disagreeable, the toss into the air and the falling back with that spine-jarring thud.

2nd. The coiled springs will make the riding of the stiff flat springs easier, but will not prevent striking the axle—one of the chief reasons why the stiff springs are put in in the first place.

3rd. To use the frictional devices, if they are adjusted

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tightly enough to do what they are intended to do, only adds to the stiffness of the action of springs already too hard. [To this the friction people will take exception, as they advocate flexible springs.] Continual adjustment is also necessary.

4th. Taking all this into consideration it would seem that in order to overcome all difficulties it would be necessary for a man to equip his automobile with rubber bumpers, strong straps, coiled springs and frictional devices, one counteracting the defects of another, and, with all on, the man is where he started or perhaps not so well off.

With a set of the Kilgore automobile air cushions you can remove the bumpers and sell them to a junk man, or give them to some other automobilist. You cannot bump the axle, for you are stopped on the downward plunge by an elastic air cushion; you can remove the heavy straps and use them to attach your luggage —for your upward flight is gradually and easily stopped, also by an elastic cushion of air.

No other device permits of the following being done:

You can remove the coiled springs and then, if the flat springs are too hard and stiff, as if more than likely to be the case, remove one or more leaves from them to give the desired spring and elasticity without danger of axle bumping or the spring breaking.

You can remove the friction devices, for, as stated above, the air cushions ease the car down as well as up, and do not require any adjustment, nor do they interfere with the free action of the spring.

A normal self adjusting and automatically balanced column of air does the work at all times without attention.

The air cushions saves tires by allowing them to get away from the hard bumps and up against the elastic, balanced column of air in the cylinders.

No shock is transmitted to the motor, transmission and other mechanism, which is the cause of 75 per cent of a motorist's troubles.

HYDRAULIC ANTI-JOLT DEVICES

It is evident that any liquid may easily be so disposed in a device as to be forced through openings of one size or another by the action of the vehicle springs. The mechanical arrangement is therefore of less interest than the dimensions and the demonstrated results. The absence of elasticity from the liquid makes the hydraulic devices real "shock absorbers," but just how acceptably the shocks are absorbed must depend upon the details of the arrangement and their adaptation to the vehicles to which they are fitted.

In the device made by P. M. Hotchkiss, 4022 Lake avenue, Chicago, the openings for the liquid are so arranged, by valve action, that the liquid does not check the compression of the vehicle springs but only the recoil. It does not, therefore, add load-carrying strength to a flexible spring or sensitiveness to a stiff one, but, as most of the other devices, is primarily intended for pleasure automobiles carrying a pretty nearly constant load at high speed.

The American Hydraulic Shock Absorber, another device made by the American Shock Absorber Company of Easton, Pa., has its valves so proportioned that the greater the shock and movement of the vehicle springs, the greater the resistance of the liquid against displacement, giving the springs full play under light load and protection under severe strains. If this feature is worked out in practice in accordance with the claims, it is of course equal to extra load-carrying capacity for a flexible spring, and means something for trucks as well as for automobiles, though it would require an examination in each case to make sure that a truck spring somewhat more flexible than truck springs usually are and compressed under a heavy load at rest would not be checked out of all action by the operation of the device, which in that case would not start from its normal neutral position.

Consideration of the merits of the hydraulic devices must be based upon experiment. The principle of them admits many possibilities, but very small differences in its application and in the dimensions of valve openings must mean great differences in the results obtained. The devices for this reason are made subject to adjustment, once for all time for each vehicle, but whether the results that may be obtained with a given device for a given vehicle may be obtained in equal degree for another class of vehicle by a different adjustment, the writer is unable to say.

ABSORBING SHOCKS BY FRICTION

The earliest of all shock absorbers were friction devices. The first Truffault shock absorber was arranged to create friction for the recoil only, while allowing free play for the first spring flexion. This type was applied to motor cycles in France and made possible some very high speeds in racing which previously the excessive vibration of front forks had prohibited. The Truffault racing "voiturette"—with air-cooled single cylinder 12 hp. motor —was also fitted with the device in the year 1900. It was soon discovered, however, that the mechanism of this original shock-absorber could be much simplified and strengthened, and the friction increased, by using the friction both ways, and without detracting from the merits of the device.

Many wonder why friction both ways—the mere deadening of the spring—should be of any value. Why not simply use heavier springs, then? Well, first of all, the heavier spring has a stronger recoil while the deadened spring has a weaker recoil. Under a given shock the vehicle weight comes down with a momentum of, say, 100 numerical value. Out of this, say, 20 is absorbed in the friction element; 80 reaches the spring and is recoiled; 20 is again absorbed in friction; only 60 remains to throw the vehicle weight back; consequently it is thrown back very much more slowly than it came down. Vibration is soon and gradually checked. If there were no friction for the downstroke, the spring would flex more but would also recoil more violently. The friction also carries load, if used both ways; consequently permits weaker and slower springs to be used.

The firms whose efforts for safe-guarding the operation of motor vehicles and reducing the cost of tires, springs and other repairs are represented in frictional shock-absorbing devices are the Hartford Suspension Co., 67 Vestry street, New York City; the Baldwin Chain & Mfg. Co., 198 Chandler street, Worcester, Mass.; the George W. Nock Company, 126 North Fourth street, Philadelphia; the Diezemann Shock Absorber Co., 1311 Hudson street, Hudson, N. J., and E. H. Godshalk & Co., 23rd and Hamilton streets, Philadelphia. Among the friction devices made by these firms the Rhodes Recoil Governor, made by Nock, offers no resistance to downward movement of the vehicle body and a resistance to

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recoil graduated to correspond with the violence of the recoil. It is therefore materially different from the devices which interpose a frictional check of constant force upon the spring oscillations of varying force.

The Rhodes device consists mainly of two flat steel bars, each 7 inches long, which slide vertically on one another within a hollow square guide box secured to the upper bar by means of a stud extending at right angles to the bar. The latter is thicker at its lower end, forming a wedge which acts, upon the roller clutch principle, on a transverse pin, normally held out of engagement with the upper bar by means of small spiral springs, but taking hold in case of a violent shock bringing the thickened end against it. The clamping effect thus produced momentarily ceases, however, by the checking of the rebound, and the bars then slide again one upon the other till their normal position is reached. The device is adapted to different vehicles by furnishing different tension springs for determining the positiveness of the clamping action according to load and requirements.

Self-Training of Drivers

Suggestions for Power Wagon Owners in the Merit System Employed by Street Railways

DRIVERS of commercial trucks and delivery wagons are in charge of a property which they may easily damage by gross recklessness or by continued use of wrong methods, and frequently in such manner that the damage will crop out later in the form of big tire repairs or sudden breakage of an axle or a gear. As soon as motor omnibuses shall be running in greater numbers than now, the same will apply to their drivers, only in a still higher degree.

How to inspire drivers with a sense of responsibility will therefore for a long time remain one of the cares in the operation of power wagons. No doubt the driving of them will become as much of a trade as the occupations of conductors and motormen of the street car lines, but the raw material from which power wagon drivers will be trained will come largely from the teamsters' class, though also from motormen, clerks and chauffeurs. The methods adopted by street railway companies for securing the right kind of service from their men present a number of parallels, so far as the requirements of the men are concerned, and if power wagon users were organized in an association permitting them to employ similar methods, a great deal would be gained toward the development of a reliable class of drivers.

Where departments of city administrations employ drivers for police patrol wagons, ambulances, inspectors' cars, fire vehicles, something is usually done in the way of examinations and demonstrations for making sure of the fitness of applicants for the drivers' positions, but, as shown by reports of such examinations as recently held in New York and Rochester, N. Y., the theoretical knowledge required of the applicants goes far beyond what could be expected of a truck driver, while the assurance derived from similar examinations as to the men's ability to treat their vehicles with a view to economy and to handle the commercial interests of their employers, in the proper treatment of customers, soliciting of orders, expansion of trade territory, etc., is probably not much better than no assurance at all.

The applicants for police patrol drivers' jobs in Rochester, for example, were required to answer the following questions in writing:

1. What experience have you had in the operation and care of electric machines? For whom have you worked, when and how long?
2. Write a report to the Commissioner of Public Safety, giving details of an imaginary accident or break down, stating the nature of the accident, the cause and what you did.
3. What would you do with a battery, if the plates were sulphated?
4. How often should a battery be washed?
5. (a) What specific gravity should the solution stand? (b) How often should the solution be tested?
6. With what would you fill your battery should the solution evaporate?
7. (a) How would you test for dead cells? (b) If you found a dead cell, what would you do?
8. If car is sluggish in motion and uses a high amperage, but armature and field do not heat, where would you look for the trouble?
9. (a) How would you test for a ground in armature? (b) How would you test for a ground in field?
10. (a) How often should commutator be examined and cleaned? (b) How do you clean a commutator?
11. How would you know if your vehicle was drawing an unnecessary heavy amperage?
12. What would you do if your car began to skid on a greasy pavement?
13. (a) How high a voltage should a 40-cell battery be charged to? (b) A 24-cell battery? (c) Why?
14. (a) What rate of amperage should a battery be charged at? (b) If charged at double that rate, what would happen?
15. (a) How would you know when a battery is fully charged? (b) Ho much longer does it take to charge a 40-cell battery than a 20-cell? (c) How long should it take to charge a cell if fully discharged?
16. (a) If a battery heats up while charging, what condition does it indicate? (b) Why should a battery be uncovered while charging?
17. (a) If a battery does not come up to full voltage after the proper time on charge, what would it indicate? (b) What would happen if a battery should be overcharged?
18. (a) What is more economical, a battery charging at high rate or at low rate? (b) If in charging, you reversed the current, what would happen?
19. (a) What is the proper rate of discharge of a battery? (b) If discharged at double that rate, what would happen?
20. (a) What is the effect on a battery discharged at a very high rate? (b) At a very low rate?
21. (a) What effect has it on a battery to let same stand charged for a long time? (b) What effect has it on a battery to let same stand discharged for a long time?
22. How would you know when your battery is discharged?

Any owner of electric power wagons might use this list of questions to advantage in hiring a new foreman for his installation, after first securing a correct list of answers from a fully competent source (the Electric Storage Battery Co.'s book of instructions answers most of them), but when it comes to hiring and training of

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common drivers, the street railway companies' methods are more suggestive of a practical manner of proceeding.

It is especially the "merit system of discipline" developed in Kansas City and subsequently adopted in other towns, which affords useful parallels. It was explained by J. G. Huntoon of Davenport at a recent street railway convention. Some extracts from his paper will be of interest.

Applicants for employment should be at least twenty-one years of age, of good health and not addicted to the use of intoxicating liquors to excess. In selecting trainmen, we prefer the married men, as being more steady and less liable to leave on short notice. We do not, however, bar the single man, but of the two applicants, conditions being the same, we would select the married man. The successful applicant for employment is required to fill out an application, giving his name in full, date of birth, name of wife, residence, name of father and mother if living, their residence, names and addresses of those dependent on him for support, the length of time and where he has attended school, previous occupation, cause of leaving last situation, whether any previous street railway experience, in what capacity employed, when and where, and cause of leaving. History of the past five years, giving each year in regular order down to date, closing with the following, "I certify that foregoing statements are true, and hereby apply for a situation in the service of the ——— Company, and if accepted, agree to maintain strict integrity of character, to abstain from the use of intoxicating liquor and tobacco while on duty, to refrain from the use of intoxicating liquors to excess while employed by the ——— Company, to familiarize myself with the general and special rules and regulations of the company, to faithfully observe the same, and to keep advised of such amendments to said rules and regulations as may hereafter be made, and to perform all my duties to the best of my ability."

The applicant is then passed over to the surgeon who examines him in regard to eyesight and hearing, defects and deformities of body and limbs, hernia, faulty heart action. If not rejected, the new man is given a thorough course of instruction in charge of an old and experienced man. Then follows an examination covering all the salient points in connection with the position for which he applies or is selected, and thereafter he is amenable to the "merit system of discipline," with which the man is first made familiar so as to know thoroughly that his job, while not in immediate danger from every little error on his part, will certainly terminate if demerits are constantly booked against him.

In brief, the system consists of a debit and credit account with each trainman, using the car index alphabetically arranged. When the demerits exceed the merits mark by 100, the party receiving them is subject to dismissal.

Every man started out with a clear record, but within a short time we noticed that a number of our men were getting demerit marks quite regularly; this continued until some had almost reached the limit, when again a change was noticed, and that was this, the men who had previously been erratic in their conduct were noticed to be endeavoring to please, and were making every effort to win back what they had lost. We have in mind a conductor on one of our lines who was constantly being reported for various infractions of our rules, and had about reached the limit, when, to our surprise, he faced about, and by careful work in looking after the interests of the company, won back all he had lost and today is considered one of our best men. Numerous instances could be cited where a man has started out wrong, but has been brought up with a sudden turn by realizing that if he continued along the same lines, he would eventually work himself out of a position.

Any act performed by our trainmen, reported to the office, that meets with our approval, whether reported by an inspector or a disinterested party, is noticed and trainmen reminded of the occurrence by a certificate of merit. We have found that by the judicious use of merit marks, the trainmen are stimulated to greater exertion in pleasing the traveling public and guarding the interests of those who interest themselves in the trainmen's welfare. The man who is first on the scene in the case of a blockade, broken down car, or wire down, who exerts himself and endeavors to clean it up should certainly be commended. The trainmen appreciate the fact that the company recognize their worth, and mentally resolve that the company in the future will again be called upon to recognize their efficiency in other ways.

The demerit sheet for motormen consists of a list containing 57 demerit and 11 merit charges. Some of these are readily adaptable, by a slight change in each case, to power wagon conditions. Only five species of misconduct are cause for immediate discharge. These are 1, disloyalty to company; 2, false statements; 3, intoxication; 4, dishonesty, and 5, gross ungentlemanly conduct.

Omitting those which are manifestly inapplicable to any business but street car service, the demerits are as follows:

6.—Failing to report accidents. 7.—Missing out. 8.—Smoking on duty. 9.—Failing to make safety stop at crossings. 10.—Incomplete and poor accident reports. 11.—Untidy condition of dress. 13.—Neglecting to pick up passengers. 15.—Allowing unauthorized person to run car. 16.—Fast running. 17.—Front headlight not burning when required. 18.—Entering saloon when on duty without good excuse. 19.—Drinking on or before going on duty. 20.—Gambling. 22.—Profanity on duty. 23.—Accidents, when avoidable in opinion of superintendent. 26.—Failing to report trouble with car. 30.—Not ringing bell at street intersections. 31.—Not ringing bell when passing car. 32.—Passing standing car without first stopping. 33.—Running ahead of schedule time. 35.—Running too close to wagon upon track, before getting car under control. 36.—Following car in front too close. 37.—Bad judgment on special occasions. 38.—Leaving car without taking reverse lever. 39.—Flattening wheels. 40.—Injury to car equipment that could be avoided by proper care and judgment. 44.—Garnishee. 45.—Talking to others than proper officers of the company about accidents. 46.—Careless and indifferent operating of car. 47.—Criticising management of road in presence of passengers or others. 48.—Failing to report delays. 49.—Not having proper tools. 51.—Running without sand in sand-box. 57.—Tampering with brake mechanism or other machinery that has been properly adjusted by regular inspectors.

The merit marks require considerable remodelling before they may be regarded as applicable to power wagon driving and merchandise delivery duties. They would naturally vary according to the duties. The list will help in making out a corresponding power wagon list, however. It is as follows for motormen:

1. Warning persons in act of jumping on or off moving car to wait for car to stop.
2. Securing name and address of witnesses who saw accident other than those named on accident report.
3. Politeness and attention to passengers noticed by company officers.
4. Assistance rendered in case of accident, such as to bring commendation from passengers.
5. Informing company of matters in the interest of good service.
6. Complete and perfect accident reports.
7. Good stop in avoiding accident.
8. Good judgment and work in handling layout or blockade.
9. Special meritorious act calling for recognition from company.
10. Careful handling of car.
11. Twelve consecutive months' perfect service.

Said Mr. Huntoon in conclusion:

Operating under this system of discipline for a trifle over three years, we are of the opinion that it is far superior to the old method, and has a tendency to bring the management and trainmen closer together, and inspire them to greater diligence in the performance of their respective duties. The system, however, is incomplete, as some other and more substantial reward should be given to those who, in one year, have to their credit one hundred merit marks—a substantial reward that will not only encourage the man who receives it, but stimulate others to a higher standard.

Perhaps not the smallest advantage of adopting a similar system for power wagons in commercial service is that its adoption would render necessary a separate and complete account for each vehicle, corresponding to the street railway men's car index but somewhat more

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elaborate. It is to be hoped that manufacturers of power vehicles may see fit to accompany the sale of each power wagon with an account book suitable for this purpose, and containing, as well, a complete illustrated list of all wearable parts with an estimate of the number of miles each of them ought to last. The mere fact that a separate book is kept of each vehicle should have an excellent effect upon the *morale* of drivers and foremen.

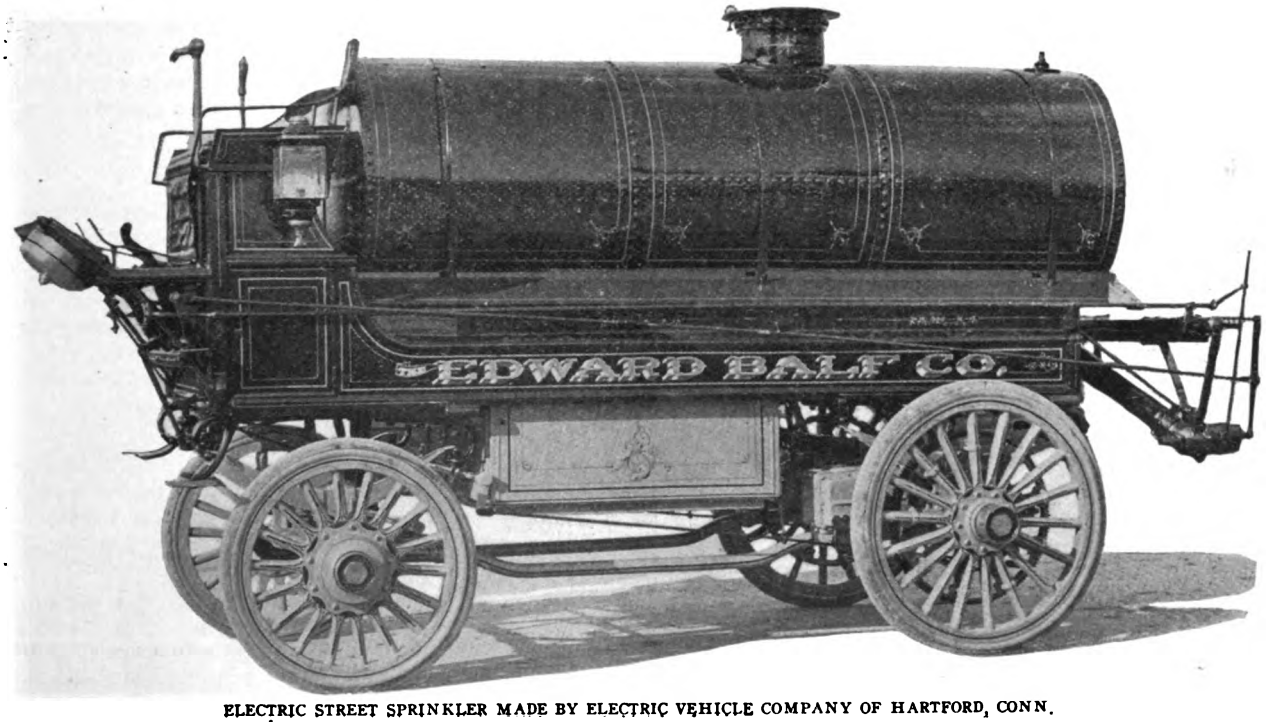
ELECTRIC BUSES ON GUARANTEE

ON another page of this issue will be found an account of the introduction of electric storage battery omnibuses in London under the auspices of the London Electrobus Company. Three hundred of them are to be placed in competition with the five to six hundred gasoline and steam omnibuses already running and the near to fifteen hundred more already ordered. Gasoline motor omnibuses with electric transmission have also been tried and the Gearless Omnibus Company has been formed with strong backing to place them in the field. London will be the veritable testing ground for public service power vehicles where shortly the whole world must go to obtain data in regard to the cost of their maintenance.

The most remarkable feature of the electric storage battery omnibus venture, however, is the fact that the makers of the vehicles are assuming the risk of maintenance cost, having guaranteed to the Electrobus Company that it will not exceed a certain figure per mile, and this figure is sufficiently low to safeguard the competition upon which the company is entering.

THE MOTOR STREET SPRINKLER

WHEN street sprinklers are at work the temperature is usually high and horses are at their worst. But this is not the reason for the economy of the motor driven street sprinkler. The economy is due to its size and the rate at which it works. It need not be filled so often as a horse drawn sprinkler; that saves time. Its speed is under exact control, while the walk of horses pulling a load is so nearly unvariable, for each team of horses, that the price of draft horses depends largely upon the speed of their normal walk. By varying the speed the amount of water sprinkled may be varied much more satisfactorily according to the needs than by the driver's manipulation of the waterflow. It is difficult to get the flow right, anyway, at the slow gait of walking horses. Going twice as fast as the horse drawn sprinkler the motor sprinkler saves one driver's wages. Less frequent stops for filling, no stops for resting and better distribution of water, are factors which practically mean another driver's wages saved. As the motor sprinkler's speed is only relatively great, not exceeding 6 miles per hour as against the average speed of 2 to 3 miles for ordinary sprinkling carts, the tire and battery expense is very moderate and does not compare with the cost of feed and keep of two horses. Hereto comes that the motor sprinkler is nimble in the traffic and responds quickly to special calls. Above all, it does not cost anything worth mentioning when not used and may be operated in the season when most needed by persons ordinarily engaged in almost any other kind of work. It is therefore much better adapted for being owned by a town or city than a sprinkler equipment.



ELECTRIC STREET SPRINKLER MADE BY ELECTRIC VEHICLE COMPANY OF HARTFORD, CONN.

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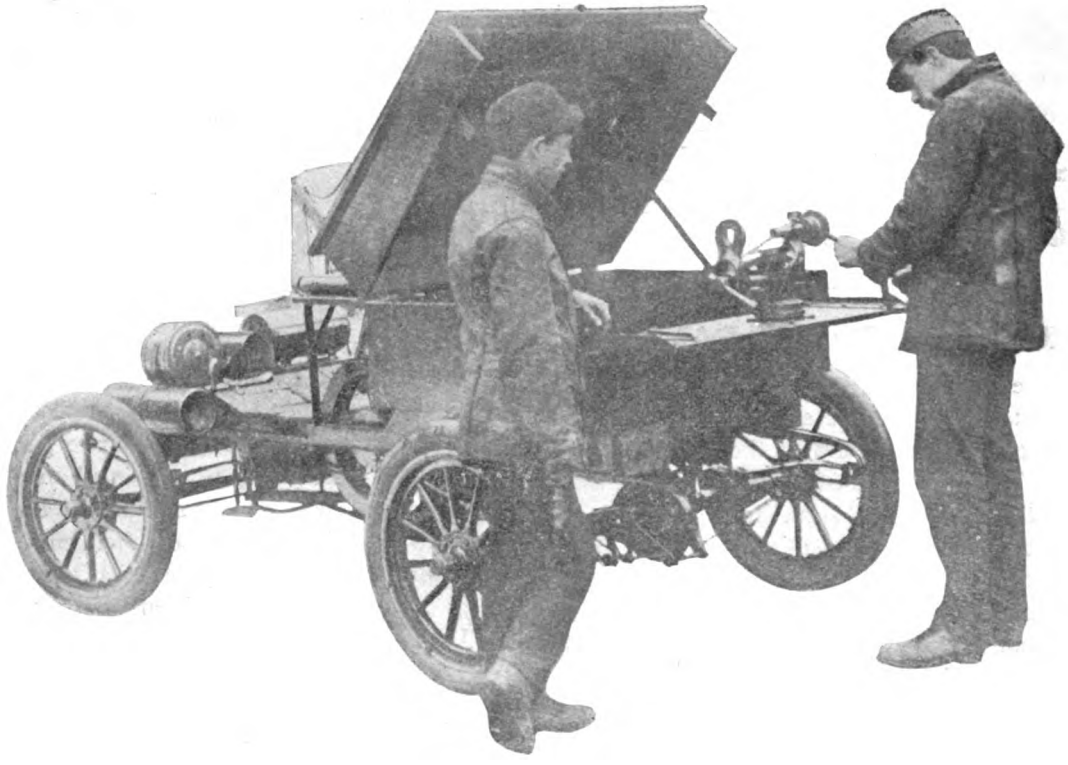
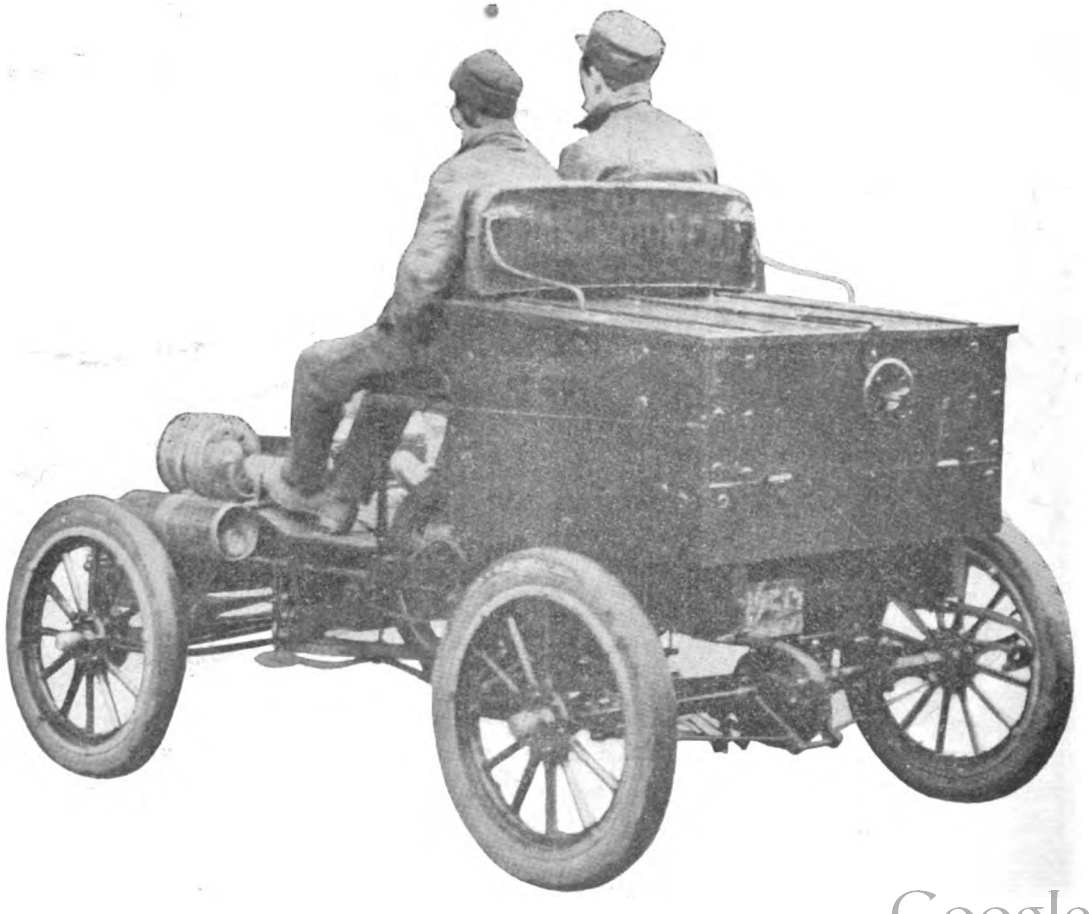


THE LESSON OF THE REPAIR WAGON

In the issue of this publication of April 26th mention was made of a repair wagon devised by the Miami Motor Car Company of Dayton, Ohio, to enable it to follow up customers who might be in need of quick repairs at the roadside. Through the courtesy of the company referred to it is possible to present pictures herewith showing the arrangement of the wagon. The box on the rear of the wagon contains a substantial work bench with a combination vise, drill press and emery grinder.

The system as shown indicates to what lengths it is necessary to go so long as systematic maintenance and inspection have not been adopted by the majority of vehicle owners, placing them beyond the risk of sudden breakage of parts or enabling them to substitute spare parts without notice whenever the old parts show signs of weakness.



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Scrap Book Records for Wagon Owners

PRESS REPORTS OF ADVANCEMENT IN THE USE OF POWER WAGONS IN AMERICA—WITH COMMENTS

AIR PRESSURE HOLDS LUBRICANT

PECULIAR wheel bearings are used in the electric delivery wagons employed now for seven consecutive years by the Gorham Company, silversmiths, of Fifth avenue and Thirty-sixth street, New York. The arrangement is described by Howard Greene as follows: Each wheel hub is fitted with a long cast iron bushing made with a wide recess on its outer circumference, so that when forced into place there is an annular space or chamber between the inside of the hub and the bushing, the chamber being, of course, closed at the ends by the full-sized ends of the bushing, which fit tightly into the hub. Quarter-inch holes are drilled through the bushing, and a single larger hole, closed by a special plug, opens from the chamber through the hub. When the wheel is in place on its axle heavy grease is forced through the hole in the hub by means of a powerful pump; the grease is forced in until it fills the annular chamber, forces its way through the quarter-inch holes and finally squeezes out between the bearing and the axle. When this occurs the pumping is stopped and the hub cap put on and the bearing is practically forgotten for from 3 to 9 months. This method of lubrication, in connection with the cast iron bearings, has been found extremely satisfactory. The chambers are large enough to carry a good supply of grease—those in the larger trucks carry about three pounds each—and there is no dripping or waste of the lubricant and no smearing of the car with oil.

"SELF-TRAINING OF DRIVERS"

WITH regard to the driver question, a highly successful garage manager has found that the establishment of two classes has been of great assistance in securing efficient service. New men are put to work at a lower rate of pay than older and more experienced hands, and are told that when they are worth it their pay will be increased. On the other hand, the highest paid men must keep up to the mark in order to keep in their class. This results in a constant stimulus, and the men are induced to do their best.

The drivers in his establishment are not experts in electrical or mechanical matters, but are taught to make minor adjustments, to make connections or cut out circuits on the road, and so on. When a car is stalled or gets into any difficulty which is beyond the ken of the driver, he promptly telephones to the garage, tells all he can of the symptoms, and is instructed to do whatever the superintendent at the garage thinks will remedy the difficulty. If this does not work, the driver again reports by telephone, and is told to do something else. While this system does not look particularly feasible at first glance, Mr. Demmert says it is the most satisfactory plan he has ever tried, and that the first telephone instructions to the driver are usually sufficient.

POWER WAGON "STANDARD" MACHINE

MOTOR vehicles, which but a few years ago were classed as a mere mechanical toy, have developed to the point where they may truthfully be said to be as "standard" a piece of machinery as a bicycle, a typewriter, or a grain-binder. The power, dirigibility, endurance and other elements of capability of the power wagon have been increased, until it is a most thoroughly practical and useful vehicle. It might be called "a dirigible locomotive," only the term suggests a ponderousness which does not appertain.

A curious instance of its economic value was given in San Francisco, when automobiles rendered most valuable service in carrying messages and gathering information from the fire swept streets, being driven where no horse could have been forced to go, and whirling on their errand with speed which no horse could equal.

Like most other inventions, it has really displaced nothing; horses and electric cars are used just as much as ever; it simply adds one more to the methods of quick transportation. And it may confidently be expected that all friction relating to its progress on the highways will be allayed, so that it will cause no more trauble on even the quietest of country roads than do the thousands of steam threshers which perambulate the country with vastly more commotion, every season. It may occasionally be driven too fast; but horses are often driven with reckless and dangerous speed. It is the common-sense users of both who will set standards of lawful custom.—*Columbus, O., Dispatch.*

THE TEST IN SAN FRANCISCO

PRESS reports abound relating to the valuable services rendered by motor vehicles, mostly of the pleasure type of course, in the strenuous work following upon the California earthquake. They are nearly all in the same strain, marvelling at the reliability and dispatch of the vehicles heretofore considered as fit to serve only frivolous ends.

A telegram from John Dougherty, acting chief of the Frisco fire department, to the Electric Vehicle Co., of Hartford, Conn., shows the impression created. It is as follows: "Three of your 45 hp. Columbias have been used by myself and Assistants Shaughnessy and Wills, continuously night and day since the earthquake, April 18, and are still in service. The machines have conveyed us over our steepest grades through all parts of the burning city, having had to run over ruined streets cracked and piled up in many places with fallen bricks, stones and other debris. Their work has been perfect at all times, and I marvel that an auto can stand up under such unusual and severe tests. Have been skeptical about automobiles previous to this great work, but I now give them my hearty indorsement." White steam cars also took a prominent part in the rescue work, with the assistance of Walter C. White, the youngest of the three White brothers. The San Francisco agent of the Olds Motor Works received three carloads of Oldsmobiles the day before the earthquake and all of them escaped destruction. The entire three carloads were turned over to the city authorities and the army officers, who used them in transporting supplies and in aiding the suffers.

MOTOR BUS DRAWS PASSENGERS

ONE 16 passenger Knox bus is running between Albany, N. Y., and Loudonville, a distance of six miles, making from six to eight trips a day and always loaded. The motor vehicle replaced a horse drawn affair. During the month of March more people were carried in the Knox than for a whole year before. The natural result is that the Knox Co. has recently received an order for a bus carrying 22 passengers with standing room for at least 12 more. The establishment of other motor lines in the vicinity is contemplated.

COLUMBUS, O., TO HAVE SIGHT-SEEING

COLUMBUS Sight-Seeing Company, recently formed, will operate a line of motor omnibuses especially for the accommodation of visitors and citizens who desire to visit the various parts of the city in a fast car at a reasonable rate of fare.

The company will use the Logan vehicles, made at Chillicothe, and which hold about 16 persons each. The promoters contemplate being able to cover the entire city in about four hours, and the charge will be about 25 cents an hour. The capital stock of the company is $10,000, and the incorporators are: Ben Williams, Bert Smith, J. B. Foster, Henry Bechtold and T. J. Farrell. Four cars will be ordered as a starter.

CHICAGO MERCHANTS TRUCKS

SEVERAL Chicago firms have contracted for trucks with the Kansas City Motor Car Company, a number of orders having been closed by J. E. Caps, vice-president of the concern. The Cable Piano Co. has purchased two wagons, 24 hp. motors, with

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bore and stroke of 4⅝ and 5 inches, respectively. Sears, Roebuck & Co. have ordered a six-ton truck which has a 60 hp. motor. M. O'Brien & Sons, dealers in art goods, have ordered a light wagon, and Spielmann Bros. Co., vinegar manufacturers, have arranged for a machine.—*Chicago Inter-Ocean.*

MOTOR MOVING VANS IN CHICAGO

THE use of the power truck in Chicago's May day moving this year demonstrated that the big van companies are beginning to see that the horse-drawn vans are out of date.

"It would not be surprising," said one automobile man today, "if all the moving in the downtown district, at least, were done by power wagons next May. The advantages of the power-driven vans over the horse vans are so numerous and the results obtained so much more satisfactory, that the moving and expressing companies will make haste to invest in gasoline and electric trucks."—*Chicago Evening Post.*

NEW IDEA IN FIRE SERVICE

THE aldermanic fire committee, of Springfield, Mass., has recommended to the allermen the establishment of a flying automobile squadron in a central engine house. It is believed that the concentration of the 20 additional firemen it is proposed to appoint will prove more advantageous than to distribute them among the engine houses. For fires in the residential parts of the city a peed of 30 miles an hour would be practicable with a self-propelling equipment.

MOTOR PLOW FOR SANDUSKY

JAMES J. Hinde, of Sandusky, O., has bought an Ivel agricultural 18 hp. gasoline motor tractor in Europe, and shipped it to his home town, where it is to be used for ploughing. The machine is now being adjusted and examined at the Dunbar Mfg. Co.'s plant, where "Climax" motor delivery wagons are made, and as a result of the inspection it is intimated by the *Sandusky Register* that the Dunbar Company will engage in the manufacture of gasoline motor farm implements.

"BATTERY CARE SIMPLIFIED"

LOUIS Demmert, who is in charge of the garage of the Gorham Company electric vehicle installation in New York, where excellent results are obtained, states that in some cases he does not adhere very closely to the instructions of manufacturers of batteries. For instahce, he frequently lets assembled cells stand dry, without injurious effects. A set was shown that had been standing for nearly three weeks without a drop of liquid. An experience of several years has failed to show any ill effects from this practice, it was said. Mr. Demmert also used separators which have not been chemically treated—a practice that would shock a battery manufacturer, he states.

NO MONEY SAVED — ONLY LIVES

DIRECTORS Buckley and Excell, of the Cleveland Board of Public Safety, are opposed to municipal motor ambulances, as proposed by Mayor Johnson. They think it would be expensive. "There would have to be at least two men at every police station. If we wished to have the ambulances ready to run at all times, we would have to have more men."

CRUDE TEST OF SPRING ACTION

THE Paris Chauffeurs' League has arranged for a competition to test the value of different kinds of motor car springs. A vessel containing milk will be carried by each car, and the race will be run over rough roads at a given time. The chauffeur who arrives at the end of the race with the most milk will win a silver medal.

STUDEBAKER ELECTRIC COMMERCIAL VEHICLES

ALL the mechanism of Studebaker electric delivery wagons and trucks is attached to the main frame, which is built from angles and T-section steel, so disposed as to give the maximum strength with the least possible weight. In this manner the use of various styles of upper bodies is permitted. The same general method of construction is followed in all sizes.

The battery is of the same durable type employed for their electric passenger automobiles. On all the electric freight wagons it is carried under the center of the frame and the battery campartment is built integral with the frame, the whole farming an inverted truss. This is a distinctive Studebaker feature, originated by them, and provides the advantage of perfect rigidity in the general structure.

The motors are placed adjacent to the rear axle, each wagon being equipped with two motors. They are suspended from the frame and transmit their power through a geared countershaft, which in turn drives the wheels, through the medium of sprockets and chains.

Two independent sets of brakes are part of the equipment of each wagon. One of these operates on the motor countershafts and the other, an internal expanding brake, operates on the inside of drums attached to the spokes of the wheels.

The wheels are of the Archibald pattern, with parallel hardened axle bearings running in removable bushings in the hubs. Unless otherwise specified, rubber tires are furnished, of widths corresponding to the loads to be carried. However, the firm calls especial attention to the fact that their method of construction permits the use of iron tires without any risk of injury to mechanical or electrical equipments. They will be furnished when specified, at a corresponding reduction in price.

The steering gear is of the wheel type, operating through pinion and segmental spur gear. The steering pivots are hardened and ground, both on the wheel bearings and the steering pivot parts. The front axle is bushed in the pivot sockets, the lower pivot being tapered to allow adjustment for wear.

Lubrication of motors is effected by absorbent pads, this being the standard practice followed in street railway motors. Lubrication of axles and other bearings is effected in the same simple manner as on horse drawn vehicles of similar nature.

The controller handle is located at the left of the driver's seat, and the controller gives four speeds, both forward and reverse.

The battery is divided into four trays, containing ten cells each. This arrangement is another distinctive Studebaker feature and obviates the expense of keeping an entire extra battery on hand. One extra tray should prove all that is necessary in the way of extra battery equipment for two or three wagons, as this single tray can be used to replace any one tray when removed from a wagon for cleaning or repairs.

Studebaker electric delivery wagons and trucks are built in sizes with the following carrying capacities: 1,000 lbs., 2,500 lbs., 4,000 lbs., 7,000 lbs., and 10,000 lbs., running gears far each of which are so designed as to accommodate bodies of different styles and bulk capacities, as may be specified by customers. The general design of the rungears for each of which are so designed as sizes.

Mail and passengers in charge of George Reid, mail contractor, will be carried by automobile over a mail route between Hayfork and Weaverville, in northern California, a distance of twenty-seven miles. The region is so remote from ordinary means of communication that San Francisco Sunday morning newspapers do not reach Hayfork till Thursday evening.

A 16 hp. motor omnibus, seating twelve passengers, has been ordered for schedule livery work between Bryan, Texas, and the Agricultural and Mechanical College in that vicinity.

Montreal, Can., is just waking up to the possibilities of motor trucks in business. Recently a Knox three-ton truck was demonstrated to leading business men in that city.

James Puller & Co., of Hartford, Conn., have taken the agency for Rapid commercial motor vehicles in the section tributary to Hartford.

Philadelphia has secured an electric patrol wagon for its central police district.

C. W. Henzler, of Bismarck, N. D., will open an automobile livery service.

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Traffic by Motor Power in Europe

MAINLY A DIGEST OF THE BRITISH AND CONTINENTAL TECHNICAL AND CLASS PRESS

FIRST ELECTRIC STORAGE BUS

Britons Staggered By Electric Invasion of Gasoline Motor Field

LONDON is to have electric storage battery omnibuses too. One has been placed in commission and three hundred more are to follow if the plans of the recently formed London Electrobus Company materialize.

It is at present going to subscription for a capital of $1,500,000 and proposes to pay $100,000 in cash and $25,000 in deferred shares for the purchase of the patents upon which the vehicles are to be built. A Baron de Martigny is the chief promoter.

The following description is given of the new bus in *Motor Traction*:

The electric motor, which is situated over the front axle, is a British Thomson-Houston, constructed in the firm's Paris works, and is rated at about 14-16 hp., but is capable of giving a very much higher power when required. Current is supplied by Oppermann accumulators, which in the vehicle in question are arranged in two sets of forty-four cells each, connected in parallel. These give a voltage of about 90, and can be discharged at almost any rate without a serious diminution in their output. The plates of these cells are of the pasted grid type, and are so designed as to withstand any rapid charging or discharging to which they may by any chance be subjected. We may say that the ordinary lead grid is not exclusively used as a foundation, and that the plates are separated by rubber balls acting as cushions, and preventing damage due to vibration. The total weight of the accumulators is approximately one and a half tons, and they are capable of giving 14 watt-hours per pound weight under favorable conditions. This corresponds, under normal working conditions, to about 500 ampere hours at 90 volts. The drive from the motor is through a Renold chain to a long cardan-shaft, and thence through a bevel differential gear to the road wheels.

The accumulators are placed in a large tray amidships, and as they need replacement after a run of about twenty miles special facilities have to be provided for their removal. For this purpose a trolley has been designed which can be run under the accumulator tray. When the long bolts holding the latter in place are taken out, the tray is lowered slightly and removed. The fresh battery, which is placed in its tray on a second trolley, is then run into position and jacked up through the medium of worm gearing and two racks and pinions, until it is raised sufficiently to allow of the replacement of the securing bolts. The operation only takes a few minutes, and can, if required, be performed upon the road.

The control is by two pairs of band brakes, acting respectively on the back wheels and the longitudinal shaft, and by the hand lever operating the controller. The armature has two separate but similar windings, which can be connected in series or parallel with one another. It rotates in the field of a four-pole field magnet, also having two windings. The forward working positions of the controller give the following results:

(1) All the windings are in series with one another and with an external resistance, to limit the current flowing at starting, when the armature is quite, or almost, stationary.

(2) The resistance is put out of circuit, but all the windings remain in series.

(3) The two armature windings are connected in parallel, the field coils remaining in series.

(4) Armature and field coils are both connected in parallel. In a short trial run, the amperage varied up to a maximum of about 240 amperes, which was the current taken when starting on the hill. This corresponds to about 29 hp. taken by the motor. The starting current under normal conditions was decidedly low.

Comment in British papers on the Electrobus and the company desiring to introduce it, are not friendly. The value of the patents is doubted; and insinuations of a stock jobbing scheme are not wanting.

The editorial remarks of *Motor Traction* upon the venture are characteristic of the flutter in the omnibus situation caused by it, but bear no witness of great familiarity with the electric developments of recent years on the part of their author. He says:

"Undoubtedly the sensation of the week has been produced by the appearance of the first electrically driven omnibus on the streets of London, and as a natural result much wild talk has been indulged in regarding the possibilities of its superseding the petrol-driven vehicle. As far as we have been able to gather, there is nothing startlingly novel in the mechanism or accumulators of the new vehicle, but we should still be very far from categorically denying the possibilities of attaining the results claimed, especially as we understand that the costs of operation have been guaranteed by contract.

"It is impossible, however, to ignore the fact that such contracts, when merely based on estimates, and not on results attained in practical work, may prove themselves 'direct losses,' whatever else they may lead to later on.

"Nor is it possible to forget that accumulators have long ago been tried and found wanting, and this, too, under the most favorable possible circumstances, namely, for tramway work.

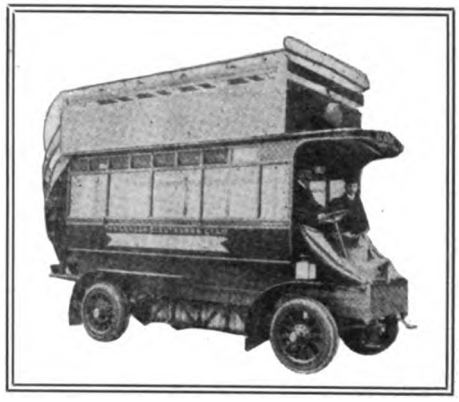
"The present greatly reduced price of current for industrial purposes certainly offers a greater prospect of success to electric traction than would have been possible a few years ago, but the claims of its supporters should certainly be substantiated by practical working, before the daily press begin glibly to talk about the supersession of the petrol omnibus, and suddenly, for some reason, enter on a campaign against the noise and smell of that conveyance.

"Knowing as we do, the cost of running private electric broughams and other cars deriving power from accumulators—although it must be admitted that the conditions of omnibus service in the Metropolis offer as favourable a field for electricity as does any branch of road motor work—we can fully appreciate the difficulties that will have to be faced by anyone attempting to obtain such results as have been claimed for the new omnibus.

"Even if these results were obtained, it does not follow that the petrol vehicle would be entirely superseded, for, quite apart from any reduction in the working costs of petrol omnibuses, a vast field would still be open to this type of vehicle in all places where electricity is not produced on an enormous scale, and therefore of an extremely low cost.

"As to the noise and smell, about which we hear so much from certain critics, these will be reduced with the advance of manufacture, and we only have to turn to the silently running private motor car of the present day to prove what strides are to be made in this direction."

It does not seem to occur to the author of the commentary, that when he says that "accumulators have *long ago* been tried and found wanting," he supplies in the words "long ago" the very reason for not accepting his inference of their present shortcomings. The trials to which he refers, have been superseded by better methods for battery maintenance, known and practised here, if not by the owners of electric broughams in London.



FIRST OF 300 ELECTRIC OMNIBUSES FOR LONDON

The question of the price of current, to which the editor of *Motor Traction* evidently attaches much importance, would manifestly be of no consequence for an omnibus company making its own current. As to "producing electricity on an enormous scale and therefore at an extremely low cost," the editor of England's "leading motor vehicle journal" is not talking by the book. The difference between the cost of current produced by Niagara Falls and that produced by a small private kerosene or gasoline engine of two horsepower, would not affect the total cost of running an electric power wagon one per cent.

GERMAN TRACKLESS TROLLEY TRIAL

THE conclusion of a series of experiments with a trackless trolley system at Eberswalde, Germany, has released for publication some instructive data. It was found that the average consumption of power, including transmission losses, was 660 watts per omnibus-kilometer. The weight of the vehicle was 3,400 kg (7,496 lbs.); power

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consumption per ton (2,204 lbs.), 153 watts; and maximum speed per hour, 14 km.

The costs of the installation, owing to unusual conditions, were exceptionally high. The estimated cost of an automobile trolley line of 3.1 miles in length under ordinary circumstances is as follows: Electric line, $9,650; two cars, $6,948; car depot, $2,702; total $19,300. The estimated annual cost of operating the above mentioned line on the basis of 30,000 car-km. annually, the cost of current furnished by the central station being 4.82½ cents per kw. is $1,737. Counting upon receipts of $3,088, or $617.60 per km., the net profit will be $1,351, or 7 per cent of the capital invested. The fare charged was 2.38 cents per person. The road at Eberswalde was in operation for a little over five months, when, owing to the unusual costs of construction and of operating and keeping the line in repair, it was withdrawn by the company.—*Sreet Railway Journal.*

ECONOMICAL HYDROGEN FOR BALLOONS

ACCORDING to *Le Temps* of April 3 M. George Jaubert proposes to employ "hydrolithe," a new compound of calcium and hydrogen, for the inflation of military balloons. One kilogram of the solid yields about one cubic meter of gas (say, 16 cubic feet to the pound), and the gas is liberated on placing the hydrolithe in water, just in the same way as acetylene is evolved from calcium carbide when that substance is immersed in water. The price of the hydrolithe, which depends upon the relative values of metallic calcium, the current of electricity, and the cost of hydrogen gas, which last is caused to pass over the metal, heated by an electric current, is said to be 10f. per kilogram (say 3s. 9½d. per lb.) Hitherto in order to obtain 500 cubic metres (17,655 cubic feet) of gas for the inflation of a war balloon it has been necessary to transport three wagon-loads of gas cylinders, drawn by six horses each, and weighing in all little short of 20 tons. Now 1,100 lbs. of hydrolithe will furnish all the hydrogen needed for one baloon, since water is everywhere available, and the dangers and risks incident upon the transport of this heavy load of gas cylinders, containing hydrogen gas under a pressure of 135 atmospheres, will be avoided, the total weight to be carried being reduced to less than one-twentieth part of that formerly needed.

For the convenience of those experimenting with balloons in this country, it may be stated from the *Comptes Rendus de l'Academie des Sciences* that the substance referred to is the hydride CaH2 which on treatment with cold water readily yields pure hydrogen in accordance with the equation:

$$Ca H_2 + 2H_2O = Ca(OH)_2 + 2H_2.$$

The preparation of this compound involves two distinct operations, the isolation of calcium and the combination of this metal with hydrogen. In the former operation, 100 kilograms of calcium are isolated in 24 hours from fused anhydrous calcium chloride by means of 150 kilowatts of electrical energy derived from a current of 7,500 amperes and 20 volts. The metal when strongly heated in a stream of hydrogen slowly absorbs the gas, and after several hours is transformed completely into the hydride. The commercial calcium hydride, when prepared in the foregoing manner, presents the appearance of hard whitish-grey lumps containing 90 per cent of the pure compound.

FINANCES AND OPERATION

Twenty Cents Operating Cost Per Mile Average London Figure

SOME interesting facts in regard to the operation of motor omnibuses are related by Joseph A. Mackle, writing from London to an American contemporary. In some respects the information is supplementary to the unbiased descriptions of the London movement given in recent issues of this publication. Mr. Mackle writes in part as follows:

The majority of the leading horse bus companies have become converted to mechanical traction, but, in addition, several large new companies have commenced operations with motor 'buses. The capital invested in London 'bus undertakings is immense, as the following will show: The London General Omnibus Co. has a capital of $5,000,000; the London Road Car Co., $2,500,000; Tillings, $2,300,000; the Motor 'Bus Co., $1,600,000; and half a dozen more have each over half a million dollars capital. So much competition has arisen between rival concerns whose 'buses happen to follow the same routes that a proposal is under consideration for several of the older-established companies to unite. If this scheme should be carried out, the London United Omnibus Co., as it would be styled, would be able to almost control the whole of the 'bus traffic on account of the magnitude of its operations. Several new motor 'bus companies are undergoing flotation at the present time with capital of $2,000,000, $1,600,000, and $1,300,000, respectively. This shows the magnitude of the sudden rush to develop this paying field of enterprise. Unfortunately—but as is only to be expected—the odious company promoter seems likely to step in, and there is great risk of both the formation of bogus companies and of overcapitalization,—for even London traffic is not unlimited. There have been issued lately several alluring prospectuses which reckon out a surprisingly low running cost and seem to have conveniently forgotten all about repairing and depreciation. Some people are likely to be bitten by the motor 'bus fever. On the other hand, several of the existing concerns are paying good and regular dividends.

Tires were at first a source of great annoyance and expense to users. Pneumatic tires were practically out of the questiton for such heavy vehicles, and of the many types of spring wheel which have been before the public during the last year there is hardly one worthy of general adoption. However, big improvements have lately been made in the construction of solid rubber tires, and these are now universally adopted—either in the single or twin variety. Most tire manufacturers will either guarantee their productions to run a specified distance—say eight or ten thousand miles—or else contract to keep them in proper working order for the sum of 4 cents per mile traveled. As low as 3½ cents per mile has been agreed to, but in any case it is rather a risky speculation on the part of the tire-makers, since so much depends both on the driver and on the quality of the roads. During the last few months several pneumatic tires suited for motor omnibuses have been put on the market; in particular the Continental Tire Co. have produced a 6½-inch tire with non-skid tread. These have had hardly time enough yet to be given an extended trial, but, where the experiment has been made, the consequent ease of running and freedom from vibration is said to amply compensate for the increased cost. Much depends upon their ability to resist punctures.

With the constant use and the big mileage covered, frequent overhauling and repairs are necessary. One or two manufacturers have contracted to keep their 'buses in efficient repair for a fixed sum per mile—about 9 cents—leaving nothing to the omnibus company but the supply of drivers and gasoline. For instance, the makers of the 'buses known by the name of "Pioneer" have entered into an agreement to keep 80 per cent of the vehicles in active service. In case of breakdown on the road the makers have to repair the vehicle straight away or else tow it back to the sheds for repair at their own cost. This arrangement seems to work well, and it leaves the omnibus company free to devote all its attention to the perfection of traffic arrangements. The majority of the concerns run their own garages, however, and each 'bus turning in at the end of the day is washed and cleaned up and then passed over to a squad of mechanics, who see that everything is right before the 'bus goes out next day. In the morning the driver looks over his machine before going into the yard to take on board his supply of oil and gasoline. In most cases the gasoline is stored in underground tanks holding, perhaps 2,000 or 3,000 gallons. By means of pumps and stand pipes half a dozen 'buses can be oiled up at once. These garages and repairing expenses make the running cost mount up to about 10 cents per 'bus mile, exclusive of wages or depreciation. The total cost per car mile

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after taking all expenses into account is generally estimated at 20 or 21 cents per mile, although the usual proviso as to the quality of the routes and efficiency of the management must, of course, be made.

Clarksons, the makers of the steam 'buses, estimate as follows for a double-deck, thirty-four-seated 'bus, doing 100 miles a day for six days a week, or about 30,000 miles per annum:

Wages per week:		Per mile.
Driver at.....£2 Conductor at £1 5/0 Cleaner at....£1 5/0	£4 10.....	1 8d.
Fuel at 5d. per gallon and 4 miles to the gallon		1 25
Lubrication		16
Tires		2 0
Maintenance		2 0
Depreciation at 20% per annum.....		1 4
Management expenses		75
Total cost		9 36d.
		say 19 cents

The takings per 'bus are usually reckoned at $24 to $30 per day.

As in nearly all towns except the center of London the motor omnibus has assumed the position of rival to the electric tram, it may be of interest here to give an average estimate of tram cost to enable comparisons to be made. Reliable figures show that the cost per mile varies much with the amount of traffic, for the track, power-generating station, and other expenses increase but slightly with increased mileage. With 20,000 tram miles per mile of route per annum, the total cost per tram mile runs up to 30 cents, and this figure falls to 17 cents when the service is about 120,000 tram miles per mile of route. A careful comparison with motor 'bus costs shows that the latter will be superior in less frequent services with less than about 45,000 car miles per mile of track (corresponding to a seven minutes' service). If the traffic requires a more frequent service, the electric tram will probably prove cheaper.

The average distance covered per day by each 'bus varies from 100 to 130 miles, and running hours are generally from 7 or 8 a. m. to midnight. The average speed maintained by the 'buses varies greatly according to the state of the traffic. While sometimes during slack hours a speed of ten miles an hour can be easily kept up, an average of six or seven miles an hour is good speed when traffic is congested in morning or early evening. In whatever traffic it is running, the motor 'bus can always pass horse 'buses and cabs, and this increased speed, together with the increased comfort, has made the mechanical vehicles very popular; so much so that people will let horse 'buses pass, and prefer to wait for the arrival of the next motor—frequently to find it full when it comes. This popularity causes the motor 'buses to have a paying load at nearly all hours of the day, even when the horse 'buses are all but empty. As a rough estimate, the number of passengers per 'bus per day would be between 700 and 800, and, taking the average fare as 4 cents, this would give receipts of nearly $30 per day, or about 25 or 26 cents receipts per mile. The usual fare is 2 cents for short distances of one or 1½ miles, with 6 or 8 cents for the whole distance. On several routes competition has unfortunately arisen between rival companies, with the result that the public get long rides for their money.

Illumination of the 'buses at night is usually effected by means of acetylene lamps, supplied from a single generator. Frequently in the past leaks from this generator have laden the interior of the 'bus with poisonous fumes, and hence the latest police regulations require all pipes and generators to be fixed outside of the body. Several firms are experimenting with electric lamps, and some "Pioneer" 'buses are fitted with incandescent osmium filament lamps supplied from storage batteries.

MANVILLE'S GEARLESS OMNIBUS

ONLY a few weeks ago a sensation was caused in the Automobile Club of Great Britain and Ireland, by the figures given in a paper read by an engineer, Mr. E. Manville, connected with trolley street railway companies and also interested in motor omnibuses. The figures purported to show that the expenses of running gasoline motor omnibuses prohibited their profitable employment in competition with trolleys. Now, Mr. Manville appears in the weekly grist of news from the seething cauldron of the motor omnibus movement, as the leading spirit in a new organization, called the Gearless Omnibus Company, which proposes to place a new, improved form of gasoline-electric vehicles in the streets of London. It has no batteries for storage of current for traction, but is said to possess a number of new features distinguishing it from the gasoline-electric system used in the Fifth Avenue 'bus in New York and the gasoline-electric railway cars operated experimentally on the Delaware & Hudson and other railway lines in this country.

An economy of 35 per cent in fuel consumption, as compared with ordinary gasoline motor 'buses is claimed for the Gearless, said to be accomplished mainly by the perfect control to which the electric transmission system is subject.

SPECIAL MOTOR WAGON STEELS

STEEL makers of Sheffield, England, and especially William Jessop & Sons, are now putting on the market new steels adapted for the various stresses encountered by the different parts of motor vehicle machinery. The *London Times* states that one of these steels is a nickel steel in which an admixture of 3 to 5 per cent of pure nickel is used for axles, cranks, pistons, connecting rods, and engine parts generally. For gears a special case-hardened mild steel is provided. A sample of 2½ per cent nickel steel has given on being tested 32 tons per square inch in elastic limit, 47.2 tons per square inch ultimate breaking strain, 25 per cent elongation, and 37.8 per cent reduction of area.

DRAWBACKS OF NON-SKID DEVICES

DEALING generally with the use of tires at the present time, the plan adopted by most motorists of today is to use two non-skid tires on the rear wheels, writes J. D. Siddeley, in a British engineering journal. It is necessary to use two, as one alone entails the whole of the braking action being done through the one tire, thus shortening its life to half its normal length. One peculiar effect of thus equipping the car with perfect non-skid apparatus on the back wheels is to make the car prone to side-slip in a very dangerous manner with the front wheels. It seems therefore necessary to use one non-skid on one of the front wheels, even when the car is equipped with two non-skid tires on the back. It may be stated generally that thus equipped a car is not so easy to handle, and the steering is not so sensitive as with plain tires to all four wheels. Moreover, in view of the decreased life of these non-skid forms of tire it is quite a debatable question, and one worthy of consideration by motorists, whether care in driving is not after all the greatest safeguard and likely to ensure a more pleasurable form of motoring than reliance upon these latest tires can afford.

Pressed Steel Truck Frames
The
PARISH & BINGHAM CO.
CLEVELAND, OHIO

The Commercial Truck

cannot afford to have anything but the BEST. The ignition is undoubtedly the heart of the power wagon.

The Splitdorf Coil

is universally acknowledged the BEST. You cannot afford experiments.

(Made in America since 1858 in the Splitdorf Laboratory).

C. F. SPLITDORF

17-27 Vandewater St. NEW YORK, N. Y.

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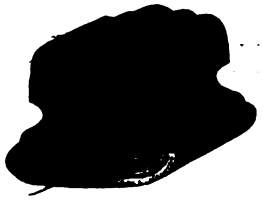


SWINEHART
MOTOR TRUCK TIRES

Not only the best, but absolutely perfect. Fastening positively secure. No retaining wire exposed to the road, sand, water and rust which is the destruction of other truck tires, but perfectly enclosed in the clincher rim. Soft and resilient and never fail under a big load.

THE SWINEHART CLINCHER TIRE & RUBBER CO.
AKRON, OHIO, U. S. A.

Keep Track of Mileage and Speed

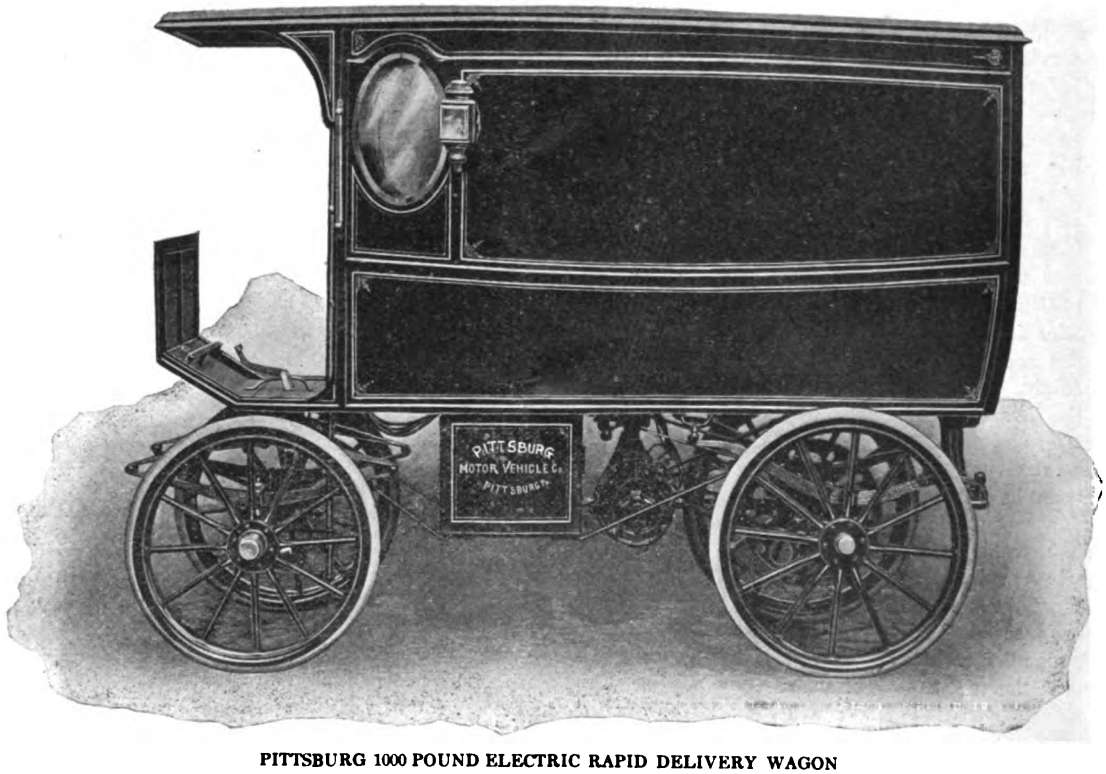
It is fully as important to register the distance traversed by a power wagon as it is to have a record of the fuel or electricity consumed, or the quantity of lubricant used. The mileage of the vehicle is most accurately registered by a ***VEEDER ODOMETER.*** If a record of both speed and mileage is required the employment of a ***VEEDER TACHODOMETER*** becomes imperative. Descriptive literature of these instruments sent upon request.

Veeder Mfg. Co., Hartford, Conn.

William P. Kennedy
Consulting Engineer

Commercial Automobile Design and Equipment *Garage and Power Plant Equipment*

1765 BROADWAY, NEW YORK



PITTSBURG 1000 POUND ELECTRIC RAPID DELIVERY WAGON

JAMES MACNAUGHTAN COMPANY, Buffalo, N. Y.
EXCLUSIVE SALES AGENTS

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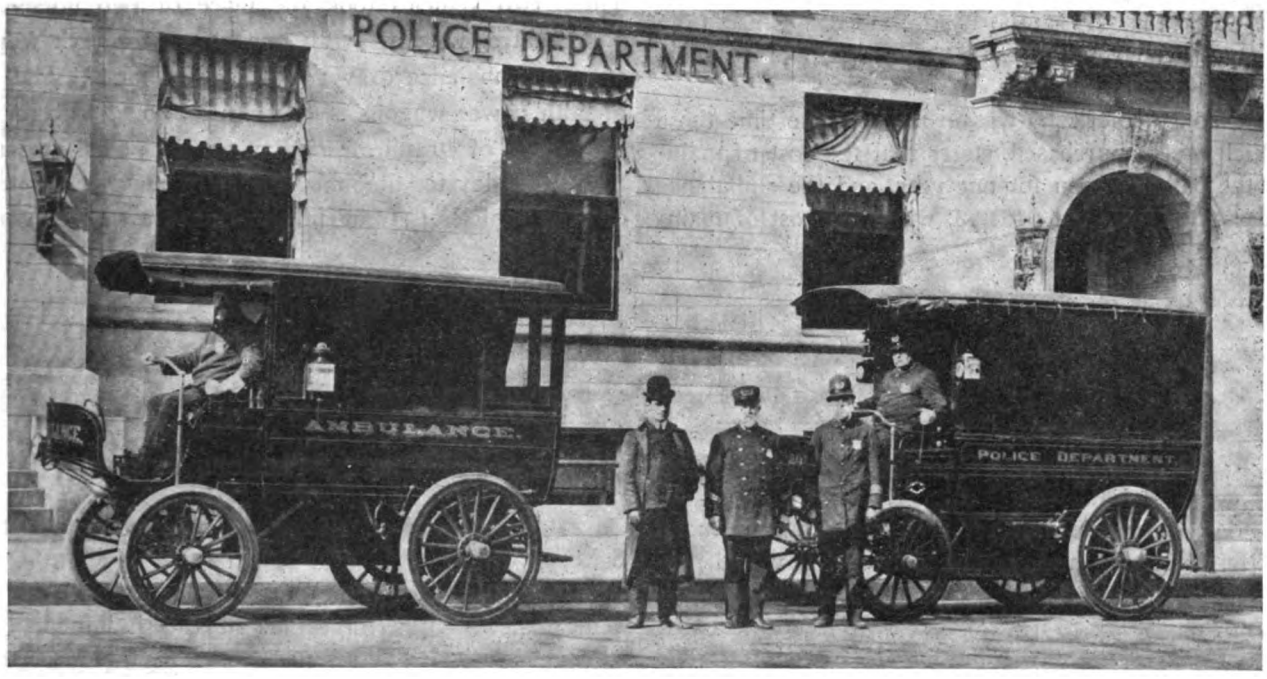
May-17-1906



Graft Hinders Progress

Manufacturers Not Eager to Compete for Construction of Automobile Patrol Wagons

WHEN it is demonstrated that even municipalities of the second order can save considerable money by the use of an automobile police patrol and motor ambulance, one naturally wonders why more vehicles of this character are not employed.

The inference of the public at large might well be that automobiles in municipal police and hospital service are not so economical as represented. Dipping a little below the surface, however, the interested investigator discovers that petty graft is in many cases responsible for the apparent official coldness to these highly useful little vehicles.

More than one manufacturer of police patrol power wagons has discovered, to his chagrin, that every well considered and decent effort to induce city officials to adopt vehicles of this character, has been frustrated by some official whose co-operation it was necessary to obtain by a money gift. There is, or should be, nothing surprising in this to people who have observed the maladministration of public affairs in our large cities during recent years.

In other branches of industry—notably the sale of fire apparatus—due allowance is made for the expense made necessary in overcoming the prejudices of scrupulous officials. This partly explains why when bids are required for the construction of municipal automobiles there is no great eagerness on the part of manufacturers to compete for the contract.

Quite aside from the fact that the product of their factories command a premium, they are unwilling to descend to practices which corrupt. Most of them are familiar with the experience of one of their brethren who found it would have been necessary to expend the sum of $300 if he desired to effect the sale of one police patrol motor wagon.

Of course, there are many cities, major and minor, throughout the country whose officials have been led to the adoption of automobile police patrol and ambulance wagons, without hope of ulterior reward. The good example they are setting is, in course of time, certain to have its natural effect upon the remainder.

Abroad the employment of municipal power vehicles of the class under consideration is so extensive as to make American municipalities suffer severely by comparison. It is almost universal practice abroad to use electric vehicles in ambulance service and this notwithstanding the flaming prejudice which exists in Great Britain and Europe against electric vehicles of whatsoever description. Aesthetic as well as financial reasons have contributed to this selection. For the moment electric police patrol wagons are, so far as numbers are concerned, in the ascendent in this country. Recently, however, the gasoline police wagon has come to command attention.

While no figures are at this moment available concerning the economy to be derived from gasoline police department wagons, owing entirely to the brief period of

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their employment, the record of the electric wagon in this same service is written clear and large. In Hartford, Conn., a police patrol wagon has been in continuous service for the past five years. This "swell gig," as it is facetiously termed, in its early career operated with such economy that the city authorities decided to install an ambulance operated by the same power. It, like its mate, has rendered excellent service.

The police chief who was in office at the time these two vehicles were purchased, states that the cost of maintaining the patrol wagon for one year, and the ambulance for five months, was but $467.98, while the cost of maintaining the horses-and-wagons which they superseded in the last year of the latter's service, was $1080.08. An acquaintance with higher mathematics is not required to figure out the economy derived from the substitution. These two vehicles took the place of two horse-drawn police patrol wagons—with two horses for each wagon—and an ambulance drawn by a single horse. The speed of both power wagons is 15 miles an hour, with an average radius of 40 miles each day for the patrol wagon and 26 miles a day for the ambulance. In summer the mileage of both vehicles is frequently in excess of these figures.

Mixed Condtions

Power Wagon Service in Which Good, Bad and Indifferent Practices Prevail

BREWERS are notorious for their extravagance in all matters affecting merchandize delivery. It would profit little to inquire into the causes for this recklessness. Allusion is merely made to it in order to refute the idea that their experience as power wagon operators is a safe guide for more conservative establishments.

Elsewhere in this issue is to be found a description of the methods employed in a Cleveland brewery for the distribution of its keg beer, power wagons being used for the service. With characteristic negligence, no account is kept of expense of operation, although as an offset there is enlightened method in many matters far in advance of what is usually found in establishments which are accustomed to keeping close track of stable maintenance. It is but natural, under these circumstances, that a concern which has employed power trucks for three years past should have no more than a few of them in its employ.

Among the many interesting features of this service, which investigation has developed, the idle horses maintained is not the least striking. The number of horse trucks in service amounts to 25; the number of horses kept in the stable amounts to 100. Three horses are usually harnessed to a truck; therefore, at the lowest computation, 25 horses are held in reserve. It is noticeable that no power wagons are held in reserve. Hence it is but reasonable to conclude that a total replacement of horses-and-wagons by motor vehicles would result in large economy, particularly as the few power wagons now in service are shown to be operating at low cost for upkeep.

It is further interesting to observe that no expert attendance is given to the power wagons. Possibly the efficiency of the vehicles would be considerable augmented if the batteries had the occasional supervision of a visiting expert. Adaptable as the brewery drivers have shown themselves to be in the matter of conforming to power wagon duties, it is too much to expect that they should be able to do all that is required for a storage battery.

The length of life which tires have shown on these vehicles is a clear indication of the judgment of the drivers in selecting highway surface over which to travel. It is not a little remarkable that one set of tires, costing about $500, should only have been required for a wagon which has been operating continuously for 3 years, during which period, at an average of 25 miles a day, the total mileage must have been in the neighborhood of 23,000 miles.

The progressive ability of the drivers of these wagons, or at least one of them, should be a matter of deep concern to those who complain about the difficulty of obtaining the services of useful servants of this character.

Such complaint as is made about the exhaustion of battery power in the wagons which traverse sandy routes in outlying districts, strongly suggests the employment of gasoline trucks. Apparently within the field of their mileage, the electric trucks are quite satisfactory.

The aversion of drivers to making longer runs with power wagons than is customary with horse-drawn wagons might be overcome by a slight increase in wages which the satisfactory work of the service apparently would warrant. Perhaps the hostility of the drivers to long runs is accounted for by the fact that the power wagons draw larger loads than horses and that more kegs must necessarily be handled by the men, whose work is, therefore, more arduous than formerly.

Despite the fact that all expense attached to the operation of the power wagons is smothered in the "general teaming account" enough is shown in the detailed report of the service to prove the economy of the vehicles. Supported by intelligent accounting and a little further investigation, it is highly probable that the company could be persuaded to completely abandon its horse-and-wagon service. Teaming in breweries is usually a waste. It is easily within the possibilities to convert it into a profit.

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A Valuable Helper

Important Work of the Consulting Engineer for Firms Employing Power Wagons

SUCCESS or failure in the employment of power wagons is often largely determined by the degree of comprehension which purchasers bring to bear upon the plain problems involved. There is no doubt that, if applied with reference to its capabilities, any well made power wagon of accepted design now on the market will and does perform its duties far more cheaply than wagons drawn by horses. But it does not follow that all the economy which is derivable from the use of the vehicle can be obtained by merely putting it in service. People contemplating the purchase of power wagons may be very well informed concerning the methods of delivering merchandize by means of horse-wagons and still be but mildly aware of the possibilities of the motor vehicles.

In illustration of this we beg the indulgence of readers while again recounting the experience of one of the large express companies.

This establishment had estimates made for the erection of stables and installation of equipment both for horse and power service, covering the same territory. The estimate for building and equipment necessary for the operation of the power wagons was about $20,000, while for horse wagons it was about $80,000. Neither case included the wagons or horses. Such saving would hardly be suspected by the ordinary team owner making an experiment with one or two power wagons. The experiment with one or two power wagons, moreover, seldom suggests the saving to be made by a complete re-arrangement of wagon routes to suit. So misleading is experiment of this character that were it not for the overwhelming advantage of power wagons over horses, it is doubtful if the general introduction of power wagons would even yet have begun.

It is fortunate that there are in this country a few consulting engineers who have made a study of the comparative economies of horse and power transportation. The mastery of one without the other is of comparatively small value at the present time. Wherever these engineers have been employed to prepare a statement of comparative investments and the resultant saving in the substitution of power for draft animals, those having the change under consideration have had before them a statement based not on "pipe dreams," but on actual accomplishments of the past, which not only indicates the stake for which they are playing, but precisely the extent to which the experiment with one or two wagons is an indication of the eventual result.

In the majority of large transportation companies the order of importance of expense items is about as follows:

1st.—Stable employees and drivers.

2nd.—Maintenance and repairs.

The remaining items, such as percentage on investment, depreciation, administration charges, fuel or feed, rent and taxes, vary so much with different conditions and localities that it is difficult to state them in order, but under normal conditions they are not worthy of consideration alongside the first two items. It is the fluctuation of the first two, according to circumstances, which favors sometimes of one kind of power and sometimes another, but never the horse when the work is conducted on any considerable scale.

That repairs have an important effect upon the wages of drivers and stable employees goes without saying. It is knowledge of the relation between the two, and knowledge of the suitability of any given power for any given condition, that makes the report of an experienced consulting engineer especially valuable and places a man of this kind in a class by himself.

Some idea of the painstaking character of the work performed by a specialist of this character may be gathered from the following report made at the request of the International Paper Company, from which the estimate of cost is purposely omitted. It is of no especial significance that the report recommended the employment of electric trucks, as the nature of the service practically demanded them.

In considering the proposition of substituting power wagons for the horse trucking method of transportation in use by the International Paper Company, of New York City, it is necessary to analyze the present system in detail, so as to obtain a clear conception of the work to be executed and discover in what particular features the change would be of material advantage.

DAILY DELIVERIES AMOUNTING TO ABOUT 400 TONS.

The delivery department of this company is at present distributing about 400 tons of paper daily from ten docks on the North and East rivers to various press rooms of New York papers. Three hundred tons go to the vicinity of Park Row, and of this 200 tons are delivered to the "Journal," principally at the Van Rensselaer building in William street, near Chambers. The remaining 80 tons are forwarded uptown to the "Herald" at 35th street and Broadway.

No marked regularity can prevail in this system of distribution, from the fact that contracts imply that the delivery must be made in accordance with the demand, which is governed by the number of editions published daily.

The proposition is further complicated by the lack of storage space in the press rooms, as well as the traffic conditions in the narrow and crowded thoroughfares of this district; both of which features have a very material bearing on the time occupied in making deliveries.

The docks from which distribution is made, as shown in the accompanying map, are Piers 16, 23 and 31 North river, and Piers 38, 40, 41, 42, 43, 46 to 50 East river. There are also two warehouses at 54 and 228 West street, at which the paper is stored and redistributed.

ROUTES FROM THE DOCKS.

The routes invariably taken from these docks to the press rooms are as follows: From the North river docks along West street to either Chambers or Barclay street, then East to Park

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row, or from E. R. docks along South street, and thence through Chambers to Park row. During the winter season Duane street is used in coming from the North river, as the car track there, being usually cleared of snow, gives a clear passage.

On account of the quantity of paper sent to the Rensselaer building it is desired by the International Paper Company that special consideration be given to the conditions existing there, as if a saving is to be accomplished by the use of power wagons it will be felt at this point more particularly than elsewhere.

The street on which this building is located is very narrow and usually crowded with vehicles. The delivery is further obstructed by the lack of elevator facilities, as there is but one elevator, and this serves the many other tenants who occupy the building. The paper is raised by the elevator only about five feet, but there is no possibility of improvement, as various experiments have been tried without successful results.

ARDUOUS SERVICE FOR HORSES.

In the present system 12 trucks and 30 horses are in service. Some are three and some two-horse trucks. The service continues both night and day and is divided into two shifts of ten hours each. Two trucks handle all uptown deliveries. Four trucks are in service at night in the Park row district. Trouble has existed in maintaining the good condition of the horses, but after considerable effort a plan has been evolved by which the horses are recuperated in the country with a particular method of feeding, which has resulted very satisfactorily. The present system, as far as its reliability is concerned, is practically perfect, and this fact must be borne in mind in arguing for automobiles.

The paper handled is in the form of rolls about 30 inches in diameter and of length varying down from 80 inches to 18 inches—80 inch rolls are used for export, 66 inch rolls for the "Journal," 63 inch rolls for the "Herald." Rolls of half these lengths are supplied to all papers as well as short rolls down to 18 inches. Paper is also made up in bundles and used for book purposes. This class of paper constitutes the heaviest loads carried. The weight of 66 inch and 63 inch rolls is from 950 lbs. to 1300 lbs. Bundles weigh from 400 to 500 lbs.

USUAL LOAD IS OVER SIX TONS.

The usual load carried by a three horse truck is 11 to 13 rolls, the average weight being between six and seven tons. Two horse trucks usually carry about 8 rolls, or 4.5 tons average. The maximum load carried is 12 tons, this being made up of bundle paper.

The average number of loads hauled per day of ten hours is five or six per truck, but sometimes, if conditions are particularly bad, only two or three trips are made by some trucks. At night the traffic conditions do not hamper the deliveries.

When pressed for time six men are engaged in loading and four in unloading. A load of seven tons is put on each truck with this number of men in 11 minutes. One roll can be put on in 1 to 1.25 minutes. The time taken in unloading is governed by elevator service and sidewalk conditions. One hour is at present required to load a truck with bundle paper.

In loading large roll paper six rolls are put on the truck platform, five rolls on the next tier, and two rolls on the third tier. This makes a full load for a three horse truck. Two horse trucks carry eight rolls, six on the platform and two on the next tier.

Dimensions of truck platform are 15 ft. 6 inches by 5 ft. 4 inches. Wheel guage is 80 inches. The height of two tiers above platform is 4 ft. 10 inches. Height of three tiers is about 7 ft. 2 inches.

BEST PERFORMANCE OF HORSE TRUCK.

An actual record of one of the best performances of a three horse truck over the principal route, which is from Barclay street dock via Barclay street, to Park row to Van Rensselaer building and return, via Chambers, Greenwich and Barclay streets, is as follows:

Truck standing on dock in position to load	1.26 P. M.	
Loaded by six men with 13 66 inch-rolls (7 tons)	1.36	10 Min.
Load roped and driver in seat	1.37	1 Min.
Actual start	1.37	
Arrived without stop cor. William street	1.56	19 Min.
Stopped blocked by traffic two minutes	1.58	2 Min.
Arrived Van Rensselaer Bldg. Unloading position	1.59	1 Min.
Elevator not available for ten minutes	2.09	10 Min.
Truck unloaded by four men	2.16	7 Min.
Started on return trip	2.17	1 Min.
Blocked by traffic five minutes		
Arrived on dock at starting point	2.37	20 Min.
Elapsed time		71 Min.

Map Showing Delivery Routes.

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Distance between starting point and Van Rensselaer building ....0.6 miles
Length of complete circuit traversed, 9300 feet.....1.76 "
Rate of travel with load .....per hour 2.30 "
Rate of travel without load .....per hour 4. "
Grade on Barclay street from Washington to Church st. 2.1 %
Grade on Barclay street from Church to Broadway.....2.4 %
Grade on Park row from Broadway to Brooklyn bridge 0.55%
Grade on Park row from Brooklyn bridge to Chambers st 0.

CONSIDERING USE OF POWER WAGONS.

All the factors of the situation as at present existing have now been covered, and it remains to consider what advantage there is to be offered by the substitution of power wagons.

It will be observed that the work is generally of an irregular nature, subject to change upon short notice and depending largely on the number of afternoon and evening editions published by the largest consumers of paper.

As the "Journal" deliveries to the Van Rensselaer building are most important, it is advisable to take that route as the basis for specification and estimate of the advantages to be derived from the employment of power wagons.

SUPERIOR SPEED OF POWER WAGONS.

Traffic conditions in this section of the city largely govern the speed and practically reduce it to between three and six miles per hour, but even at this low speed the facility with which the power wagon could be handled will make a material reduction of the time required for a given number of deliveries. In addition to this the machine would have the advantage over horses in quickly making the return trips. The type of horse employed in this work rarely can be induced to go faster than a walk with or without a load. Another point is that better progress would be made in winter, as has been proven here with large power trucks. Horses at this time are usually overburdened in this service and many stops have to be made to allow them to recover their wind on the Barclay street grade.

ELECTRIC HOISTING APPARATUS.

Efficient mechanical handling apparatus, electrically operated, for loading and unloading the paper will considerably enhance the value of the power wagon, not only as a time saving device, but also in reducing by half the number of men required for this operation.

The most forcible argument which can be made for the machine is that a greater tonnage may be carried per trip, and it is along this line that special effort should be made in dealing with this particular case.

The short route and slow speed are two factors which will render the construction and successful use of a ten-ton power wagon practically feasible. This, too, without having to deviate much from the specifications of the present five-ton truck built to go at six to eight miles per hour, and thus there is little risk in the nature of an experiment.

CONSULTING ENGINEERS' RECOMMENDATION.

If the vehicle structure can be built substantial enough for the work to be done without assuming undue proportions, it is certain that the electrical equipment regularly manufactured and in service will accomplish the propulsion within limits which will allow ample satisfaction and a working capacity sufficiently extensive to warrant adoption.

The truck most suitable for this work is the open platform type, of sufficient strength to transport a load of ten tons normally, and twelve tons occasionally. The platform dimensions should be at least 16 feet long and 7 feet wide, free and clear to carry a load of 18 rolls of paper, 80 inches wide and about 30 inches in diameter; built up in three tiers of six rolls each, so arranged that the centers of the rolls of each tier will be in line with each other vertically.

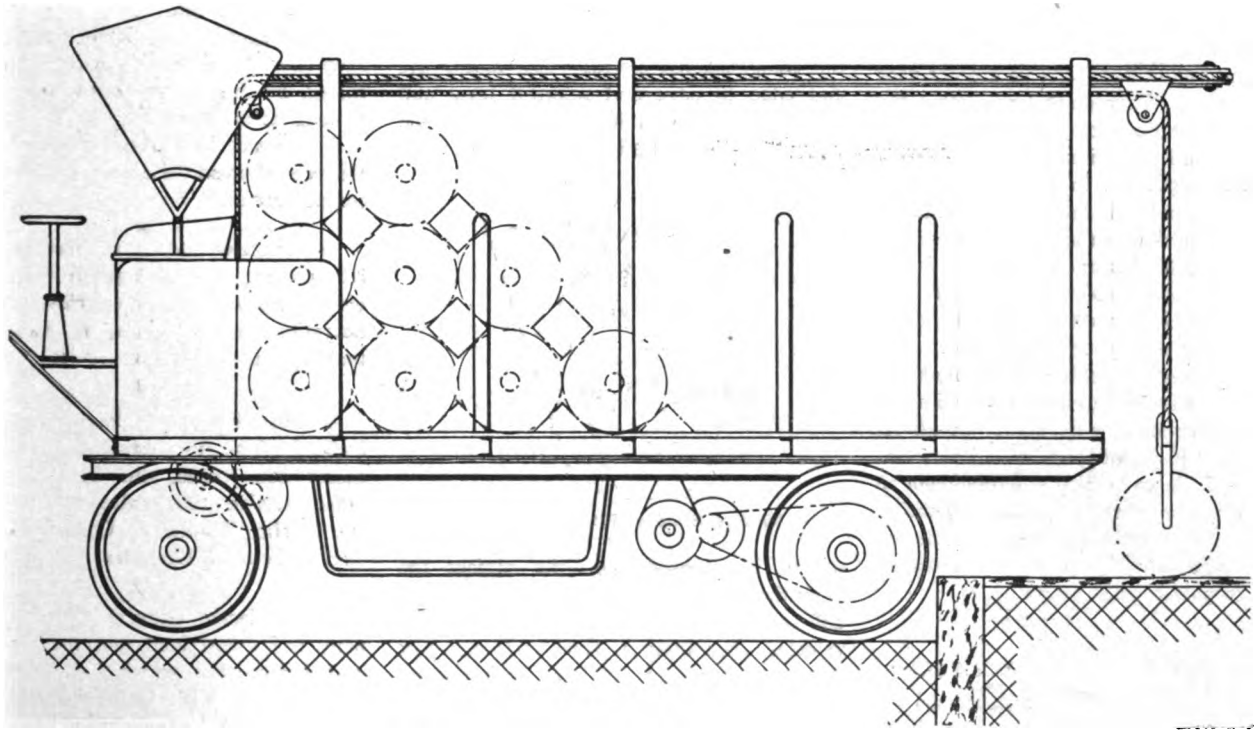
Separators of some kind should be furnished for the purpose of keeping the rolls of the second and third tiers in position horizontally.

Removable side stanchions should be furnished for use when bundle paper is hauled.

Provision for access to the battery should be made by having a removable trap door in the platform immediately above the battery.

The platform of the present horse truck slopes gradually from the center to the rear to facilitate the feeding of the rolls to the end of the platform when unloading. This would not be necessary where a mechanical handling apparatus was in use.

The wheels, on account of the low reduction of the motor speed, should be about three feet in diameter, and equipped preferably with rubber tires. It would seem advisable in the present case to use two tires, four inches wide, side by side on each wheel rim. This would insure considerable reduction in the cost



Wagon Which The Consulting Engineer Recommended.

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of maintenance and repair, as but half the complete tire would suffer injury from ordinary causes.

Due to the possible difficulty that may be experienced in starting a ten ton truck, it might be advisable to use iron tires on the front wheels, and rubber tires only on the rear. If this method should be adopted, the iron tires should be made to conform in appearance with the rubber tires, as otherwise there will be a disagreeable contrast which will have an effect on the whole vehicle.

Particular care should be given to providing the driver with a good back and foot brace, so that he may be able to absolutely control the steering and the brake.

THE NECESSARY POWER EQUIPMENT.

The proper electrical equipment for the service required of this truck would be as follows:

Two motors, 80 volts—40-50 amperes.
A storage battery, 44 cells, with capacity of 250 to 300 ampere hours.
Series-parallel four speed controller.
One main and reversing 4 pole switch.
Combination volt and ampere meter.
One concentric charging receptacle.
One concentric charging plug and cable.
Two side lamps, one head light, and the usual wiring and details.

FOR THE OPERATION OF HOIST MECHANISM.

One slow speed motor 80 volts—18-20 amperes.
One regulating and reversing controller.
The vehicle motors above specified should each weigh about 380 lbs. and run at 850 revolutions per minute.

The storage battery as above would weigh 2470 lbs. without trays, and would have a capacity of 260 ampere hours with a discharge rate of 65 amperes for four hours.

The details of the steering gear may require particular study, but it is advisable to adopt the method used in the standard heavy truck and improve it afterwards, if necessary.

DETAILS CF LABOR SAVING DEVICE.

Regarding the handling apparatus, the most efficient method would consist of a traveling reversible carrier, suspended from and traveling along a steel I-beam rail, supported over the center of the truck by two arched standards. These standards would be attached to the platform frame and located directly over each axle. The rail should project a few feet over the rear end of the platform to pick up the rolls in loading, and in unloading to place each roll on a pair of skids, which would convey it ito the sidewalk, where it should be received by the usual hand truck and taken to the elevator. The movement of the carrier would be controlled by two systems of wire cable, passing to two drums mounted under the front of the platform. One system would convey the carrier from end to end of the platform, and the other would rise and lower the hoisting part of the apparatus. The cable drums would be operated by the motor above specified, the control of which would be governed by the regulating and reversing controller.

This device would be capable of handling the paper either in rolls or bundles, and the construction of the supporting frame work as suggested would constitute a physical protection against overloading the truck with a greater number of rolls than it is designed to carry.

All the principal features of the machine are covered above, and it only remains to minutely specify the details. None of these details are, however, sufficiently complicated to have a material bearing on the cost of the truck. It is presumed, therefore, that the foregoing furnishes ample information on which to base the intended estimate.

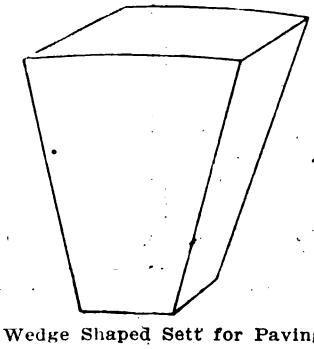
Respectfully submitted,
WILLIAM P. KENNEDY, Consulting Engineer,
1765 Broadway, New York.

SPREADING DESIRABLE KNOWLEDGE

QUITE a number of years ago an experienced gas engine maker, speaking of the difficulties then being encountered in making headway against the prejudice and ignorance of the public, remarked: "It is a campaign of education. People are not used to the engine. They don't know what the engines are or how to operate them, their advantages and their limitations or the possibilities incorporated in them." "A campaign of education" is an apt description of much of the period of the automobile so far. Anything which adds to the campaign is desirable. One of the courses at Purdue University will include a complete study of ignition apparatus now on the market. Columbia and other universities throughout the country are also keenly alive to the importance of automobile engineering in all its branches. Add to all this the endeavors of the Y. M. C. A. to furnish enlightenment to those owning or contemplating the operation of an automobile, and we cease speculating upon the difficulty of breaking horse-wagon drivers to power wagon duties.

ARMORED ROADS—NO SIDE SLIP

MUCH interest is being displayed abroad in the construction of a street surfaced with wedge-shaped granite blocks. In place of the customary square or oblong setts blocks 3½x3½x4 inches are laid with the wider end uppermost, forming a segment of a circle. The macadam is first scraped to a depth of about six inches and a layer of fine sand is laid down as a foundation for the wedge-shaped blocks. The blocks are laid edge to edge and rammed level and firm. Then fine sand is brushed over the surface to fill up the interstices. The more



Wedge Shaped Sett for Paving.

weight is imposed upon the surface the more the stone wedges bind. This pavement will not show holes from the action of heavy vehicles. It retains its level surface, is not dusty and does not jolt light or heavy vehicles. Power wagons, shod with steel tires, have been driven over it with less noise than when driven over macadam. Another of its marked advantages is the elimination of side slip.

The cost of this paving, excluding labor, is about 72 cents a square yard. Macadam costs 28 cents and ordinary granite setts $1.80 per square yard, labor excluded. Upkeep amounts to nothing with this new surfacing, which is guaranteed to last ten times as long as macadam.

The sand foundation accounts for the absence of noise. The surface looks like a coarse mosaic.

Within two weeks a gasoline automobile passenger and baggage transfer service, employing eight vehicles, will be in operation in Coffeyville, a Kansas town that has no street car service.

Berlin financiers have applied for authorization to establish eight new motor bus routes, this being a proposal quite outside those already in hand by the Berlin Tramways Company and the Berlin General Omnibus Company.

The Vienna General Omnibus Company has ascertained that the type of 23-seated motorbus which has recently been experimented with is too small. Larger vehicles will be employed hereafter to hold about 34 people.

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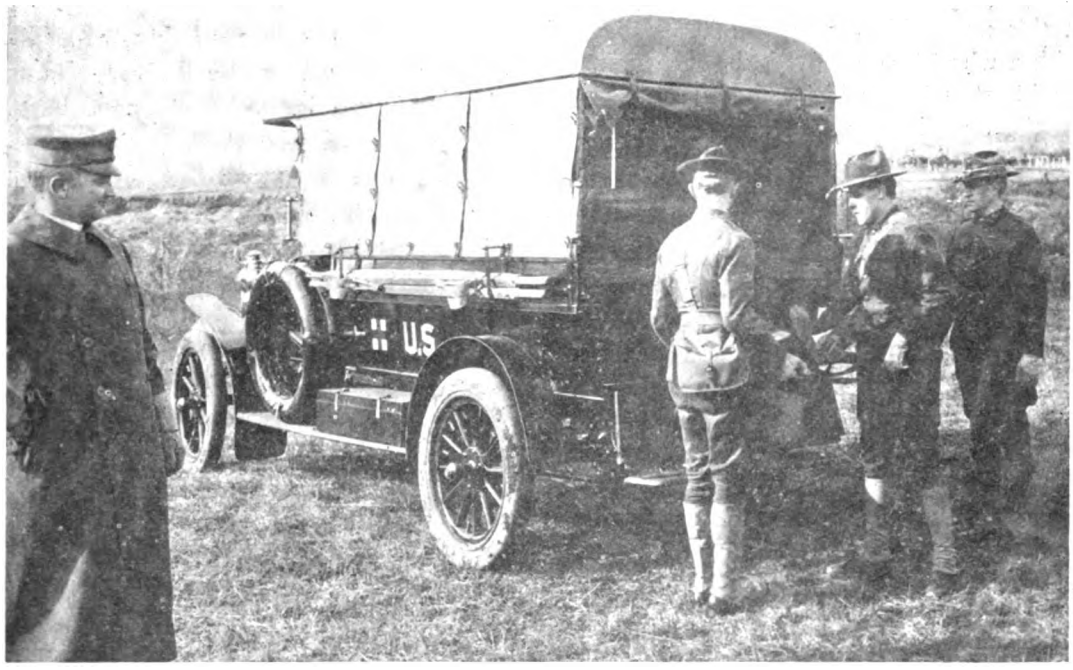

Army Motor Vehicles

Trifling Experiments by Authorities no Indication of Great Saving to be Accomplished

CONSIDERABLE stir is being made over the employment of an automobile ambulance in army service at Fort Myer, Va. This is the third branch of army work into which the automobile has been pressed, the signal corps and transport departments each being provided with vehicles which are being tested for field operations.

No one expects that the army authorities will immediately place heavy orders with manufacturers for the construction of these vehicles, for this is not the Washington method. In all probability, following the leisurely practice in matters of this kind, it will be two years or more before authority is issued for the construction of any more vehicles of this or similar sort.

It is worth while remarking, in considering the trifling character of the United States army installation, that the hesitancy which evidently is felt over the adoption of power operated vehicles is not shared by European governments, whose war ministers are eager to dispense with horses and mules where these beasts are employed in pacific military work.

In all probability a competent investigator could prove to the authorities in Washington that a vast sum of money is being foolishly squandered each year through the employment of horses for the mere transport of men and munitions, and the maintenance of a gay but by no means potential throng of horses and drivers. Army administrators, however, are seldom very considerate of matters in which mere economy is involved. And yet there is a fine opportunity for some administrative officer to calculate how much the service might be improved in efficiency, and how much of a saving might be accomplished, through the employment of motor wagons. In these dull times of piping peace the honors of "distinguished service" may be acquired through other means than tickling bolomen with bayonets.

Coming to a consideration of the automobile ambulance now in service, one finds that it is operated by an 18 hp. steam engine, justification for which selection of power is naively admitted to be "that it introduces no new element into the department, and involves the installation of no supplies not already provided for in the existing classifications." A typical expression of army logic.

It is with difficulty that mirth can be restrained when reading the concluding reasons which impelled the *assistant surgeon* who selected the ambulance in question to overlook the advantages of gasoline and electricity as forces for the operation of army vehicles. This is his challenge:

"While the gasoline machine still represents the result of experiment to a certain extent, in that its motive power has not been adopted to any wide extent in the engineering world up to the present time, the steam car represents an advancement on a system long in use and one well known."

If this is a specimen of the reasoning which led to the selection of steam as a motive power for army vehicles, one cannot help feeling grateful for the little that has been done to introduce the automobile into service. It might enlighten this cocky officer, who obviously is more familiar with bandages and splints than he is with prevailing automobile engineering practice, to know that of the

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thousands of power propelled vehicles in commercial service in this country barely a score, if so many, are fitted with the method of propulsion he vaunts so highly.

In effect this automobile ambulance is a converted touring car, with a wheel base of 132 inches, and with its interior fitted with stretchers which are slung on heavy oak poles from the top of the car. Twelve persons may be carried. The cost of the vehicle is slightly in excess of $3,000.

The official justification for the employment of automobile ambulances is summed up in the following language of the before mentioned assistant surgeon:

"Now as to the possible extent of the use of motor ambulances in army work, I should say that it would be confined to base transportation for the most part. That is to say, to work where a comparatively large body of troops is sent out on a campaign which is to be of considerable duration, thus necessitating the establishment of a base of supplies. In such cases, of course, hospitals would be set up, and in case of action all sick and wounded would be taken there from the field hospitals and receiving stations as soon as practicable. Up to the present mule-drawn ambulances have been used, and their rate of speed is so slow and their capacity for continuous work so limited, that such work involves either a great consumption of time, or else the use of a very large force, which is impracticable in most cases because of the great expense coupled with the fact that the equipment is utterly valueless except in time of action.

"For such work, then, which from the nature of things must be for the most part only in territory which is supplied with fairly good roads, I think that the motor ambulance can be used to the utmost advantage, and can be made to replace from four to ten mule teams, according to circumstances. That is to say, depending on the conditions of the roads and the possibilities of maintaining a good rate of speed. But for anything of the nature of pioneer work, where highways are to be abandoned and all sorts of unfavorable conditions met, I think that the mule team cannot be superseded, at least not at present."

ACROSS GRASS PLAINS

THE Compagnie de Transportation has concluded arrangements with the French government for an automobile service between Kaves and the River Niger, a distance of 115 miles. The route lies mainly across grass plains, these being readily passable in the dry season. Only a moderate speed, however, is attainable. About fifty cars have been ordered from France for this service. It is proposed to employ Chinese drivers. They are said to be more trustworthy than the natives, and can stand the climate well.

MOTOR BUSES IN GREECE

TWO companies have approached the municipal authorities of Athens, Greece, with a view to establishing motor omnibus services in that city and its suburbs. The authorities have refused to grant them any special privileges. Nevertheless, one of the companies intends to import a number of omnibuses and start service as soon as possible. Apart from the hostile attitude of the municipal authorities this enterprise will be handicapped by the heavy duty on gasoline and by the unsatisfactory conditions of the roads. This is an experiment that will be watched with interest, as few European countries are so poorly served by railways as Greece.

MOTOR STREET CLEANING WAGONS

PURCHASE of two or more motor wagons for hauling ashes in the suburbs of Cleveland, O., has been advocated by the superintendent of the street cleaning department. It is calculated that two motor wagons can perform the work of the nine horse-drawn vehicles now employed. The superintendent also advocates the purchase of six small automobiles for the use of himself and assistant and the four district superintendents, at a cost of about $500 each, to cover the 435 miles of streets.

$360,000 FOR GASOLINE CABS

NOT long ago the Central Motor Car Company, of London, secured a contract to build 200 gasoline cabs for metropolitan use, the purchase price being $360,000. The vehicles are to be delivered within six months.

ELECTRIC FIRE ENGINES

THE municipality of Charlottenburg, Germany, is about to institute a service of automobile fire engines. A new fire station which is being built in Suarezstrasse is to be equipped solely with electrically driven engines. The sum of $150,000 has been voted for the equipment of the new service.

MOTOR POSTAL VANS

THE Bavarian postal authorities have organized a staff of mechanics to take control of the motor vans that are being put on the roads to replace the present vehicles. A number of these mechanics have been sent to Berlin for technical instruction. They will receive a salary of 1,410 marks per annum, and be provided with leather uniforms.

The principal motor omnibus companies in London buy gasoline in quantities of 6,000 gallons, which represents full storage capacity in the garages.

Deep Snow no Impediment to Four-Wheel-Drive Wagons.

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Attention

MUCH is said in complaint, and more surmised, of the cost of power wagon repairs. Yet it seldom occurs either to inexpert operators or owners that steady, persistent attention to the vehicle's needs is of all methods the best calculated to keep repair bills from mounting so high as to be unpleasant to contemplate. Instead of waiting until something serious occurs to put the wagon out of commission, and then pulling a wry face over the interruption to service, ordinary prudence should counsel that it is better to become so familiar with the principles of construction that small troubles may be remedied before they become chronic and thereby endanger mechanism which at the outset was not impaired. For instance, it frequently happens that a driver hears an unusual sound in the gear box of his wagon, and instead of immediately ascertaining the cause thinks it is merely the wheels wearing a little. He goes on driving, until one day the wagon breaks down. When the gear is taken apart he is probably informed the bearings have been allowed to wear so much that the shafts have lifted, with the result that the wheels have not been running in mesh correctly, the teeth are ground away, and it is necessary to fit new bearings throughout the gear box, as well as several new gear wheels; the sum of which is that he cannot have his wagon for four or five days. Errors of omission like this are costly.

ONE CAUSE OF ENGINE KNOCKING.

Drivers frequently complain to the administrative stable foreman that their engines are knocking, holding themselves blameless for this aggravating mischance and breathing maledictions upon the head of the wagon maker. Examination just as frequently develops that the lubrication is insufficient and as a result the bearings have rapidly worn away. If the engine had been run a few days longer, a bearing would probably have broken, and the connecting rod would have smashed the crank case. As it is, all the bearing parts of the crankshaft have been scored, and it is necessary to re-turn them in the lathe and make special bearings to fit. It is not always fair wear and tear that runs up the repair bill.

CAREFUL USE OF BRAKES.

Brakes should be used with judgment, especially when driving over greasy streets and roads. With both wheels locked the wagon will skid on greasy streets. Injudicious braking with heavy loads will cause rapid wear on tires. Careful drivers test their brakes with frequency, not, however, with such severity as to work mischief on tires. Novices usually apply the brakes and steer in the opposite direction when the rear end of a wagon is slipping toward the street curb. In wagons with overhanging bodies this ocassionally results in the overhang striking a lamp-post, street garbage box, or pedestrian. It is safer to ease the steering towards the curb and not apply the brake. This enables the rear wheels to recover, while if the wagon comes in contact with the curb the shock is encountered broadside.

STRAINING THE STEERING GEAR.

Moving the steering wheel while the wagon is at rest tends to unduly strain the joints between it and the front wheels. Of course, there are cases when it is difficult to avoid moving the steering wheel when the wagon is at rest, especially when turning in narrow roads; but as far as possible the rule should be adhered to of never forcing the steering wheel until the road wheels are moving.

SIGNAL BEFORE STOPPING SUDDENLY.

Unless certain that there is no vehicle close behind, never make a sudden reduction of speed or come to a quick stop without giving a warning signal. The customary way of announcing the intention of slowing or stopping is to raise one hand in the air, so that those following may see it readily. Rear end collisions are undesirable, to say the least.

CAREFULLY EXAMINE FRONT TIRES.

If the front tires of the wagon are wearing more rapidly than they should, it is well to ascertain if the wheels are parallel. The least departure from parallelism causes sliding friction between the tires and the road, with disastrous results to the tires.

When pumping up a tire raise the wheel clear off the ground with a jack. It saves a lot of strength.

SUBSTITUTES FOR GASOLINE.

Different grades of gasoline may be mixed together with fair results. For instance, 65 degrees gasoline may be mixed with 76 degrees, but of course reducing the density, making about 70 degrees. Experience in mixing was evidently lacking when the following mixture was made: 2 quarts 72 degrees gasoline, 1 quart 68 degrees gasoline, 2 quarts benzine. This mixture reduced the density and made a poor fuel, but nevertheless the truck made the trip to the oil supply house and return without any trouble. Benzine (generally between 60 degrees and 63 degrees Baume) may be substituted for gasoline. This being a very low density will give less power to the motor. Kerosene may be substituted for gasoline. It will work fairly well providing the motor is hot, when the kerosene is applied. It is almost impossible to start a motor with kerosene when the motor is cold, but by the exercise of much patience and cranking the motor will run by fits and starts until it becomes thoroughly heated. If it becomes necessary to use kerosene the spray nozzle of the carburettor will need a little larger opening, or the air supply must be cut down. After the motor has been run with kerosene the cylinders should be thoroughly cleaned out. Remember, too, that kerosene is very injurious to spark plugs.

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Motor Buses For New York

Big Public Service Company Inquires Abroad For Chassis For Passenger Vehicles

IT is hardly left to the imagination to interpret the significance of the following communication which has just made its appearance in a British power wagon journal:

Sir:—This company is desirous of securing information concerning the principal makes of motorbuses, both foreign and domestic, to enable it to decide upon the practicability of acquiring a number of vehicles for operation upon its routes in this city. Any assistance which you can render, by bringing this to the attention of your principal advertisers, will be very greatly appreciated.

The conditions in New York City practically prohibit the use of a double-deck bus. The congestion of traffic, moreover, makes it essential that the control of the vehicle be flexible to a high degree, permitting, if possible, starting from a standstill and accelerating quickly to full speed without change of gears, i. e., all on the high speed. The vehicle should have, if possible, a seating capacity of 28 persons.

Our present inquiry concerns itself more particularly with the chassis, as it would be preferable to import the chassis only, equipping it with a suitable body on this side. We refrain from furnishing detailed specifications at this time, as we are anxious to leave the matter as open as possible in order to secure the greatest possible amount of information.

NEW YORK TRANSPORTATION COMPANY,
Wm. H. Palmer, Jun. (Engineer).

Hitherto the New York Transportation Company has chiefly confined its activities to the operation of eletric public service cabs. Some time ago, however, it attempted the operation of an electric bus, but failure marked the effort to establish its serviceability. This miscalculation, it is but fair to add, was not due to any shortcoming in the motive power, but rather to the commercial necessity for extending the vehicle's operations beyond the safe limitations of its battery mileage. This and defects in body construction, hinted at in the letter above presented, led to abandonment of the enterprise.

While the popularity of the company's present service in New York is undoubted, its limitations fully justify the management in seeking to widen its sphere of operations by the employment of cabs and buses operated by other power than electricity.

Mr. Richard W. Meade, president of the company, in the course of a letter recently written to the publisher of *The Power Wagon,* stated:

This company, which is already the largest user of passenger motor vehicles for commercial purposes in the world, has large prospective fields into which its business can be extended as soon as it can obtain omnibuses which can be operated with a fair degree of economy.

Where these "large prospective fields" lie is, of course, of mild concern at this moment. It is highly important, however, to observe that the claims have been staked, so to speak, and that the expectations they excite parallel those which were current abroad a year ago and which today have been converted into commercial enterprises of large magnitude.

Doubtless Mr. Meade is familiar with the fact that it is possible to hail a gasoline cab at Waterloo station in London and be transported to Brighton, 60 miles away, in three hours over splendid highways and by attractive scenery, with no more cost for operation of the vehicle than is represented by one gallon of gasoline for every 16 miles. The cabs which make this and similar radial long-distance trips from London are fitted with engines which develop 10 hp. at 900 revolutions, high tension magneto ignition, and with body of somewhat unique design, it being entirely closed in and usually seating two passengers, but with room for three as occasion may arise. The appointment of the vehicles is unusually fine. These cabs are short, and, therefore, suitable for traffic in large cities. The gauge is 4 feet 8 inches, and the wheel base only 7 feet. It is worth while remarking in this connection that the Scotland Yard authorities, which exercise control over all traffic in London, have made it imperative that commercial motor vehicles, as well as horse-drawn vehicles, shall be easily turned within a prescribed radius of 25 feet.

Probably, also, the chief executive of the New York Transportation Company is aware of the millions which have been subscribed within the past six months for the purchase of motor cabs and motor buses in all the capital cities of Great Britain and European countries, and is fortifying himself against the time when the movement which has swollen so large abroad will engulf this country.

But these are matters of passing moment.

Apart from the evident intention of the New York Transportation Company to expand its commerce, and the recognition of the means by which this expansion is to take place, there is observable the curious desire to obtain information concerning the principal makes of English motor buses which, as a matter of fact and recorded history, are largely composed of mechanism which has been contrived in Europe and put to test on English streets and highways.

Of English motor bus and motor cab manufacture, barring coach work, there is barely a trace, or if any none available for export to America. Automobile industrial conditions abroad are much worse than those which reign here. There is insistent and persistent demand for vehicles, with small capacity to supply them. On top of this, the few British concerns which are making steam and gasoline buses and gasoline cabs are from six months to one year behind deliveries for domestic and colonial use. It is quite evident, therefore, that whatever aid the New York Transportation Company hopes to obtain in order to expand its service must come from American manufacturers, who, however short they may be on commercial experience, are by no means behindhand in matters of construction relating to just such vehicles as apparently the big public service company in New York requires.

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At this moment this country alone contains concerns who could contract for the manufacture and speedy delivery of gasoline omnibuses and cabs.

The import duty upon any omnibus or cab chassis which the New York Transportation Company is likely to obtain from abroad will make their investment in the vehicles double what would be required if the resources of our manufacturers were taxed to produce them, while at the same time giving no guarantee of excellence which may not be duplicated in this country. It is some time since American automobile buyers came to a clear recognition of the trivialities in construction which mark the difference between European design and native design.

FARMERS USING POWER WAGONS

THE tenants on an English estate are about to institute a motor service on a co-operative system for running to market centers. The use of motor traction by agriculturists is making satisfactory progress in England, and the railway companies are actively co-operating.

In another part of the country the large landholders and farmers have co-operated to obtain the service of automobiles in getting dairy products to market.

The secretary of the Agricultural Organization Society states that the co-operative employment of automobiles by farmers reduces the cost of haulage from and to remote rural districts so materially as to make a considerable addition to the profits of farmers. In at least one instance it has been calculated that the productive value of certain land has been increased by fully fifty per cent in consequence of the introduction of the motor wagon service.

WORM GEAR DRIVEN BUSES

AT the Paris automobile exhibition in December, 1904, one of the French manufacturers showed a vehicle in which a worm driving a specially cut hollow-toothed straight spur wheel took the place of the ordinary bevel gear drive. The pitch of the worm was high enough to permit power transmission from the spur wheel to the worm, as well, so that no difficulty was experienced in pushing the vehicle to and fro when the power was off. A similar principle has been incorporated in the driving system of the Dennis omnibuses, which are among those most popular in London at present.

FIRST MORGUE MOTOR WAGON

THE authorities of Pittsburg have decided that with a few minor changes, not affecting the mechanism, the automobile ambulance used in Washington, D. C., by the government will serve as a model for the construction of a county morgue motor wagon. Although the purchase of the wagon will not be decided upon until the commissioners meet, it is understood that all agree to the arrangement and that bids will be advertised for in a short time.

There are now over 400 motor buses operating in London.

Four motor wagons have been sent from Germany for use in the campaign against the Herero rebels in Southwest Africa. The consignment consists of the three wagons for goods transport, and one to carry men.

It is proposed to supply agricultural produce direct from the producer in the southwest and central parts of Essex to the consumer in London by means of power wagons. Some very influential people are interesting themselves in the venture.

The Munich civic authorities have ordered a motor wagon for use in connection with the municipal power works, having arrived at the conclusion that a self-propelled vehicle is indispensable for effecting rapid control of and repairs in their high-tension cables. They intend to purchase, at a cost of $4,250, a vehicle which will be provided with a roof for carrying repairing tools and materials.

The head of a famous firm of coach builders recently told a daily newspaper representative that the trade was suffering very severely owing to the popularity of the automobile. The introduction of the rubber tire, too, has added so many years to the life of the carriage that wealthy people who formerly had their carriages touched up annually now only do so every three or four years.

QUICK LOADING DEVICE

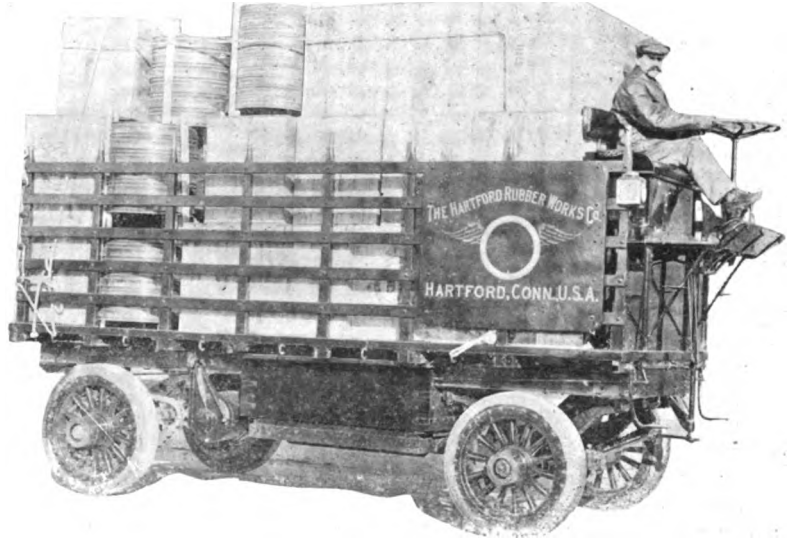
IN order that delay in loading may be avoided the makers of a gasoline truck used abroad make provision for the employment of two separate and interchangeable bodies, the loaded body being dropped on to the chassis by means of a crane. The time thus saved permits the truck to be operated at maximum economy.

SELLS MULES—BUYS POWER WAGONS

EIGHT mules and four wagons, owned by the Toledo Transfer Company, have been sold to make room for two power wagons. The stockholders of the company expect to gradually replace their entire mule wagon equipment by the employment of motor vehicles.

A motor omnibus company in Cairo, Egypt, expects to have 50 or 60 vehicles in service within the next three months. The Alexandria Tramway Company has followed the example of certain English tramways, and is about to order motor buses to feed its system.

The Portuguese government has ordered four 5-ton power wagons and ambulance. The wagons draw 3-ton trailers. They are for use in the rough country in the Portuguese possessions in West Africa.



Five Ton Columbia Electric Truck Speed Loaded, 6½ Miles an Hour.

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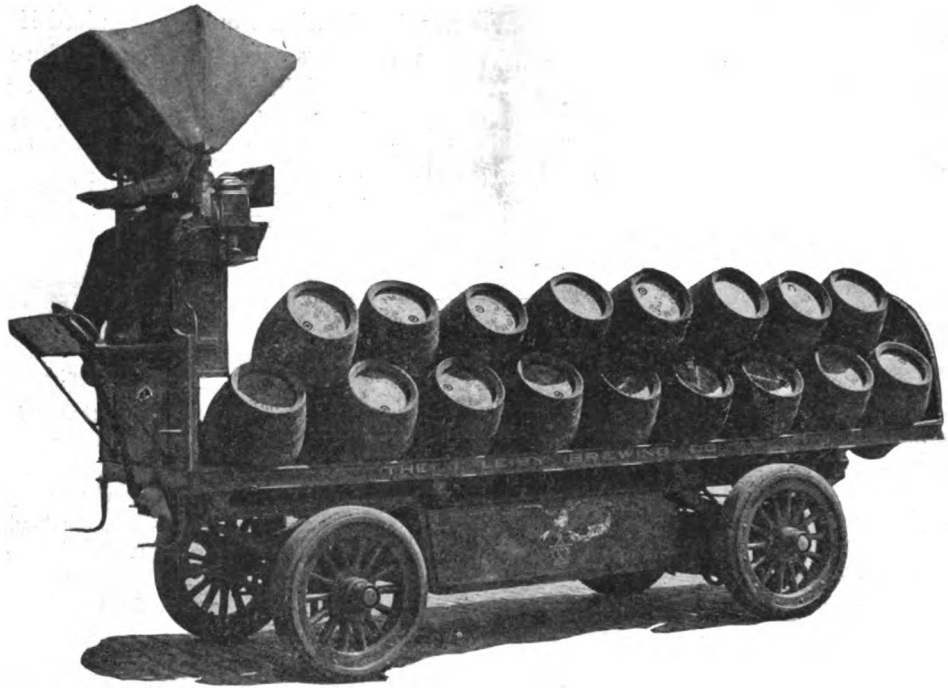

Typical Brewery Installation

No Account Kept of Costs of Operating Although Wagon Economy is Quite Apparent

ONE of Cleveland's leading breweries, the Leisy Brewing Company, is operating three 5-ton electric trucks in the delivery of keg beer. One of these was purchased three years ago, while two others were installed last July. The fact that the company bought two more machines after trying one for two years is in itself a substantial endorsement of the efficiency of the wagons. The first wagon purchased was equipped with two 3-horsepower motors, driving on the rear wheels with double reduction gears. The other two are equipped with two 5-horsepower motors, geared direct to the rear wheels. The older truck weighs 7,800 pounds, while the newer ones each weigh 9,200 pounds. All three wagons have 44 cells of battery. The batteries weigh about 2,400 pounds, and have a capacity of 224 ampere hours, 110 volt current being used.

The company operates 25 horse driven trucks in addition to the three electrics, and owns in the neighborhood of 100 horses. Its stables and yard cover about half an acre. It has its own blacksmith shop where repairs to the electrics are made. The power wagons are kept in a separate barn, fitted with cement floor and wash rack for cleaning. Here is a switchboard, equipped with ammeters and voltmeters for several circuits, so that all of the wagons can be charged at once. Current is obtained from the company's electrical plant in the brewery.

No record is kept of the amount of current consumed, nor of the cost of current in the station. The company figures that as it owns the plant the current costs nothing. Maybe not. Let us see. The manager states that they burn 25 tons of coal per day, adding: "I don't think it would make any difference in our fuel consumption whether we charge those batteries or not."

Perhaps not. But a little calculation, something like this, tells a different story: Fifty-six amperes at 110 volts equals 6.16 kilowatts; three cars each operating ten hours daily equals 184.8 kilowatt hours per day; at 2 cents per kilowatt hour, probably the cost of generating current in a plant of this size and character, would equal $3.69 for current consumed.

This estimate, however, is not exactly fair in this instance, because it is the practice to charge the wagons for about an hour at noon, at which time a considerable portion of the motor load throughout the plant is not operating, and again for three hours in the evening, when the plant is practically all closed down except for a few small motors in certain departments and the illumination, which latter is a small part of the load. The charging of the power wagons usually comes at a time of minimum load and has a steadying effect upon the load for the day, which is a most advantageous arrangement for an isolated plant of this kind.

The wagons are operated by the regular drivers of the beer wagons, three of them having been "broken in" for this service. The men receive the same pay as the other drivers, and if a wagon goes out of commission its driver immediately takes a horse-drawn vehicle over the route of the disabled power vehicle. There is one disadvantage to this arrangement. The drivers object to making longer runs with the power wagons than is customary with the horse-drawn vehicle. The company has humored the men in this respect, so that it does not get any greater mileage out of its power wagons in a day than it formerly did from the horse-drawn wagons, which they have superseded. The routes have not been rearranged to accommodate the greater speed of the electrics. Frequently, the power wagon men get back to the barn earlier than the horse drivers, in which event they put in their time caring for the machines. One of the drivers has had charge of the first machine since it was installed, and has acquired considerable skill in caring for it and the others. He now has supervision of all three machines, but they have had no expert attendance at any time since their installation.

Motors have required very little attention. The trucks are fitted with solid rubber clincher tires, seven inches wide. On an average of about every six months the tires have had to be reset and revulcanized at an expense of $12 to $15 each. The old wagon in use three years has had one new set of tires at $100 to $125 each. It is the practice to have an extra wheel and tire always in good condition, so that a car is not laid up for tire repairs. It has been the practice to have the batteries overhauled and cleaned about every six months. This has been done at a local factory at an expense of about $70 each. The driver in charge of the wagons has studied this work and in the future expects to do it himself. He believes that the positive plates should be renewed about once a year, which will cost about $100. The cells are tested weekly with hydrometer and are maintained at a

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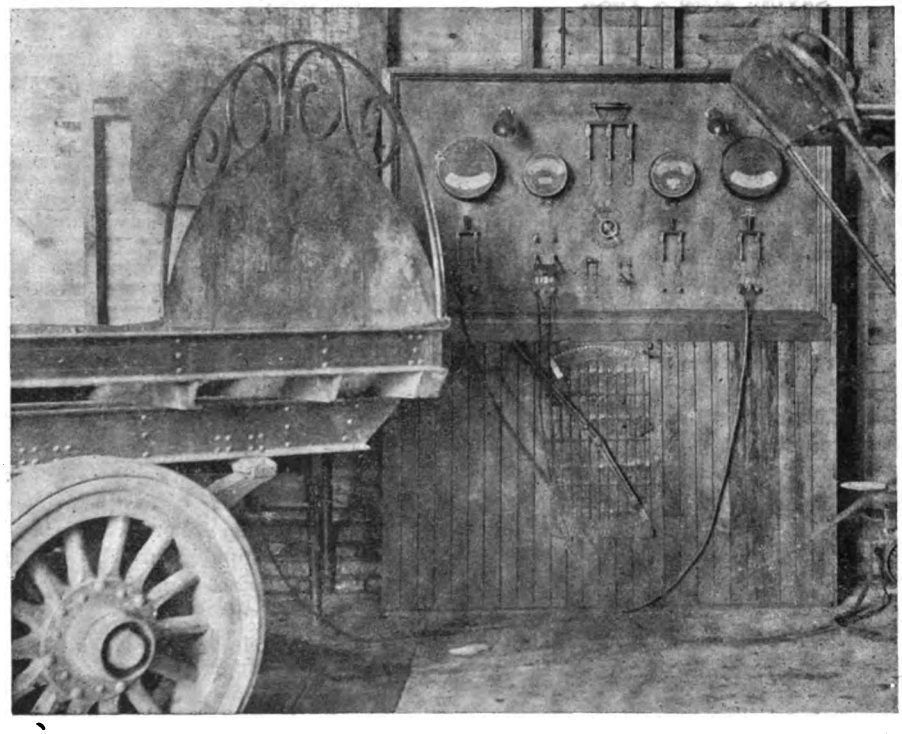
specific gravity of from 1,250 to 1,300. As already stated, the batteries are charged for an hour at noon and from 6 to 9 each evening.

The routes have been chosen with a view to avoiding grades and unpaved streets. It has been very difficult to select paved routes, as a large number of the cross streets are unpaved, while the character of the service, customers being scattered all over the city, with a great many of them in the outlying districts, makes it rather doubtful if the company will put on many more of the wagons until a greater proportion of the streets are paved. The trucks have no lack of power, and they are frequently overloaded.

The brewery and charging station are not in an ideal location. It is located on the west side of the city, while the bulk of the trade and the majority of the paved streets are on the east side. One of the routes covers the downtown district, and over this one of the power vehicles is used most advantageously. The route covers a district about three-quarters of a mile wide by about two miles long. In it there are 47 customers, the majority of them large consumers. All the streets in this district are paved, and there is but one long grade, 4 per cent, which is descended when the vehicle is loaded and ascended on the return trip when it is loaded with empties. Usually the car makes two trips a day over this route, but on hot "thirsty" days it makes three and four trips.

No. 2 wagon covers a west side district three miles long by a mile wide. It supplies 24 customers and makes two trips a day. A considerable portion of its route is over dirt roads. Its district lies nearest to the station, so there is less waste mileage.



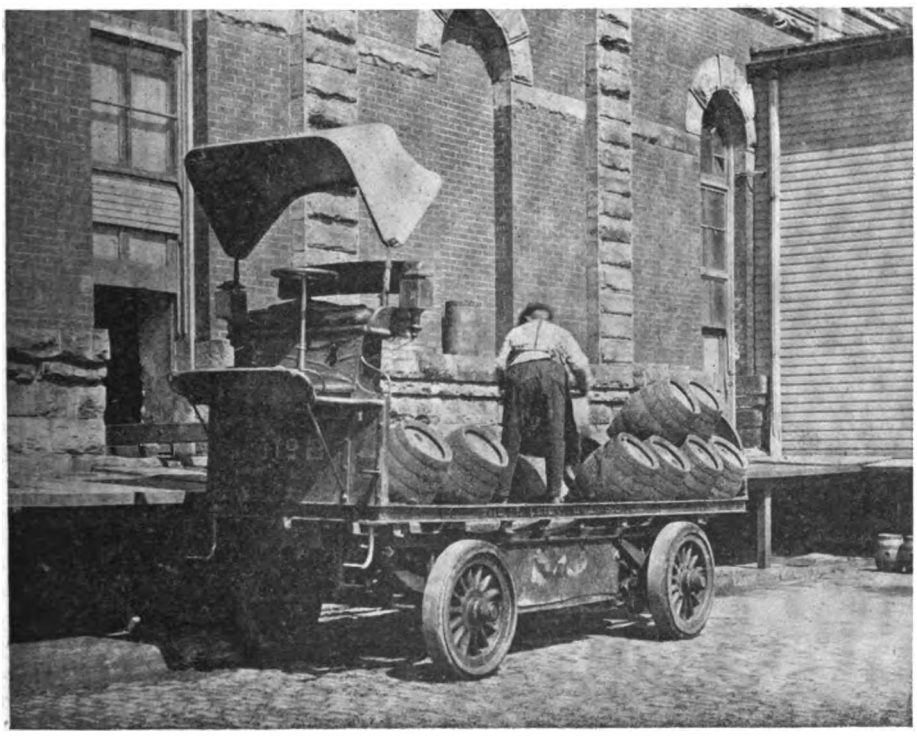
Leisy Truck Taking Juice.

No. 3 wagon covers a district two and a half miles long by half a mile wide, in which there are about 25 customers. This wagon labors under the disadvantage of having a trip of two and a half miles before its first customer is reached, carrying full load. Three times a week it makes two trips a day, and one trip each of the other three days.

The average daily mileage of each wagon is about 25 miles. It is the practice to load about six tons at the start, but as there are large consumers at the beginning of each route, the load is lightened considerably early in the trip. Returning to the brewery, the empty barrels weigh about a ton. On the wagons which have the longer runs, and which encounter considerable sand, the voltage usually drops from 65 to 70, so that the return is not made at maximum speed. This reduces the saving in time for the entire route somewhat, but it is considered advantageous of the life of the battery, as the greatest vibration comes when the car is light.

The drivers say each truck does the work of four and perhaps five horses. When the trucks are out of service it is necessary to use three and sometimes four horses to handle the same loads, but the usual practice then is to load lighter and make more trips. The trucks have lost very little time from being laid up for repairs, due to the practice of having duplicate wheels and batteries.

Due to the practice of charging the operating expenses to the general "teaming account," and keeping no account of mileage or current consumption, it is impossible to gather any intelligent idea of the actual economy of this installation.



Drivers Handle Their Own Freight.

The retail price of gasoline in London has recently been quoted at 36 cents a gallon. In Germany it is often quoted at a higher rate.

In Leeds, England, the city authorities have established a municipal department for the maintenance of automobiles. The council provides motor vehicles for its lighting and tramway committee, a motor driven derrick, a motor van, motor omnibuses and other motor conveyances.

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SAVING $1200 A YEAR

CONSIDERABLE publicity has already been given to the economical value of the gasoline wagons employed in the service of the Chicago Public Library. It is reprinted again for the purpose of showing how accurately performance can be made to tally with expectation in the matter of operation when power wagons are entrusted to the care of skilled hands:

"Having just verified the cost of maintenance of the Knox automobile in the Library service for the past year, I am pleased to submit a copy of the figures. November 1, 1904, I submitted to the board of directors of the Library the following estimate of cost of running the automobile per month, and after a year's service I find the actual cost was as follows:

	Monthly Cost. Estimated.	Actual.
Gasoline, oil, etc.	$27.00	$29.75
Tires	15.00	17.08
Repairs	22.50	18.15
Total.....	$64.50	$64.98

Average daily mileage, 48 miles.

"The work was formerly done by two wagons and five horses; saving over horse-wagon service, $100.00 per month. The fact is that a greater saving could have been made if we had bought gasoline and oil in large quantities. The gasoline and oil for the first six months averaged $36.50 per month, and for the last six months $23.00 per month. The other two automobiles are giving perfect satisfaction.

(Signed) W. A. PURER,
Supt. of Delivery Stations."

Chicago, Nov. 26, 1905.

A feature of the new German budget, which imposes a graduated scale of taxes on motor cars, among other objects of luxury, is the provision exempting automobiles used for industrial purposes.

AN IMPORTANT CONVERT

THE most widely known trucking company in Europe is Pickkfords, Limited, which has been in existence upwards of three hundred years. The close association of the firm with steam railway interests has been a large factor in building up its business. It is of more than ordinary interest, therefore, that this concern is now making liberal use of power wagons of all descriptions. Some idea of the magnitude of this firm's operations may be gathered from the fact that 300 tons of iron are annually required for shoeing its horses and 17,500 tons of provender for feeding them.

MOTOR BUSES IN CEYLON

IN the island of Ceylon a company has accepted the conditions of the government for running a service of motor cars for mail purposes on the Anuradhapura-Trincomalee section. The contract is in force for five years, with the option of renewal for an equal period, at a subsidy of 25,000 rupees a year. The order for suitable cars is to be placed at once in England, and the service will probably be started in July. The cars will carry the mails and six passengers.

A motor hearse is operating in Paris, propelled by a 24 hp. gasoline engine.

The public printer at Washington, D. C., is preparing to employ automobiles in the service of the government printing office.

Carson, Pirie, Scott & Co., department store of Chicago, have bought a two-ton Knox gasoline truck.

Automobile ambulances will be put into service by several Paris municipal hospitals. It is the intention of the superintendent of the hospitals to gradually replace all horse-drawn ambulances with motor vehicles.

LOGAN AIR-COOLED MOTOR

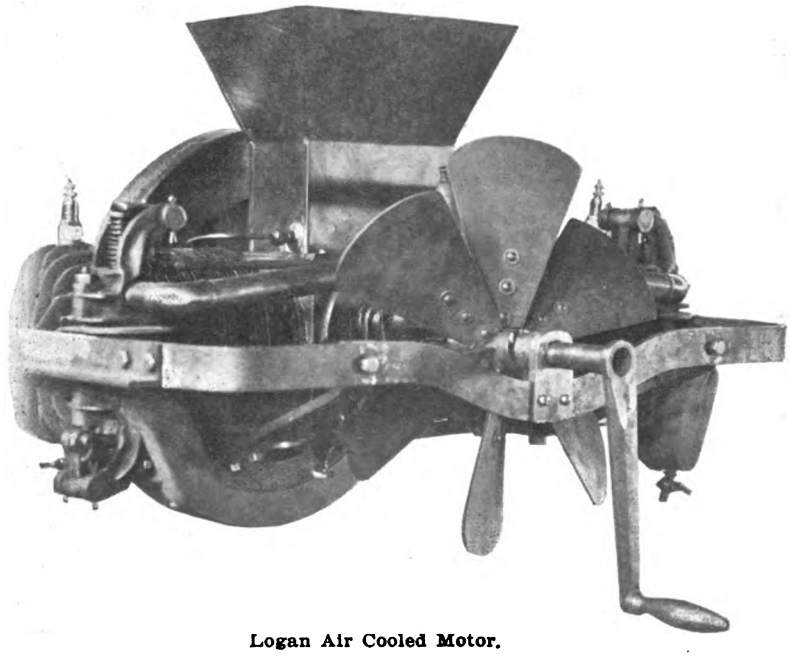
EXPERIENCE has demonstrated to the makers of the Logan delivery wagons that it is desirable to cool a motor developing up to 10 hp. by means of an air blast from a fan attached to the main crank shaft.

The Logan motor is two cylinder opposed, cooled by means of sheet copper flanges which are perforated and tapered so as to nest over each other on the cylinder body, which is one-quarter inch thick, 35 of these flanges being necessary to cover the cylinder length. Each cylinder has 54 square feet of sheet copper radiating surface. A point of the highest thermal importance is the manner of mounting the flanges on the cylinder, insuring close contact of the copper and the cylinder wall throughout the entire range of working temperature, enabling the Logan motors to use 75 pounds compression without overheating, thus giving the engines extraordinary power for the cylinder diameter and effecting a saving in fuel over air-cooled engines of lower compression. The cooling is materially assisted by an 18-inch 6-blade fan attached to the forward end of the crank shaft.

A combination motor ambulance and police patrol wagon is in service in Philadelphia.

The Compagnie Generale des Omnibus, whose three horses abreast are such a feature of the Parisian streets, has decided to order twenty-two motor omnibuses.

An attempt is about to be made to run a motor omnibus service in Cairo. The Societe des Omnibus du Caire has imported two types with which trial runs are at present being made. Should the result be satisfactory a further order will be placed, and an efficient motor omnibus service initiated.



Logan Air Cooled Motor.

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May 24- 1906
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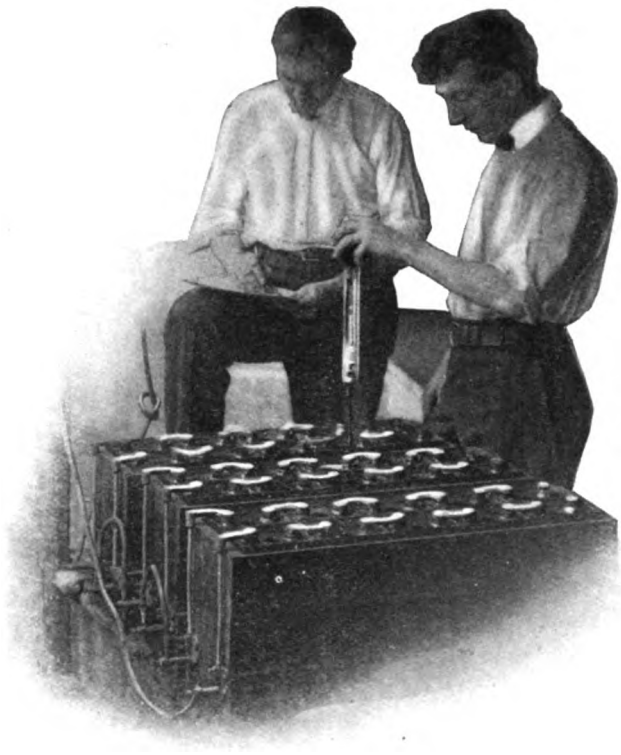

Taking Specific Gravity of the Electrolyte (acid) by Hydrometer.

Stabling Electrics

A Brief Review of Stable Economies Afforded by the Employment of Electric Vehicles

NO great outlay is necessary in order to suitably equip a small electric wagon stable. The required apparatus is simple and standard. The stabling of a large number of wagons does not require investment in proportion to what is needed for a few vehicles. Indeed there are economies to be practiced in stabling large numbers of wagons which would not ordinarily be suspected by a firm considering their employment for the transportation of merchandise.

Stable wages, so important in the operation of any type of power wagon, are heavily reduced where only electric wagons are employed. This is one of the marked advantages afforded by the use of electric vehicles, and largely accounts for the superior economy they show when a considerable number of them are employed.

One competent battery care taker can give the required attention to one hundred batteries in active service just as conveniently as he can give atention to one, and further can guarantee that 100 per cent of the service batteries shall be in service all the time. The same quality of expertness, however, is required for the care of one battery as for the care of a hundred; hence, if only one or two light vehicles are in service, an expert must be regularly employed to get the best results. In many cases sufficient funds are not available for the employment of such a man in such limited service. When this is the case, it is generally expedient as a matter of economy to use gasoline vehicles. Storage batteries do not require continuous expert attention; on the contrary, they only need occasional expert treatment. But however small the care, it is absolutely essential that it be of an expert character.

One careful battery man, one boy and one washer complete the pay roll of a small electric wagon stable.

It is to the advantage of the electric wagon stable that the rate of insurance is no higher than is quoted for buildings where horses are stabled.

A great many people are made timid over the employment of electric wagons by the thought that there is something mysterious in the agency employed as a motive power, as well as the factors required in charging. As a matter of fact, the elements which enter into the maintenance and operation of electric wagons are unusually simple and capable of the most perfect control. It is not, however, to be inferred from this that such vehicles are equal to all city uses, for it must be clear to those who have given even the most casual study to the subject that when the safe battery mileage of the electric wagon is exceeded, the employment of gasoline or steam vehicles becomes imperative. Operated within its battery mileage limitations, however, the electric wagon shows, and has shown, abundant ability to supersede horse-drawn wagons and compete with rival forms of power wagons.

In the majority of cities where electric wagons may be operated the current can be delivered to the stable by the local light and power companies, which are ready to perform all such service in the way of wiring, etc., free

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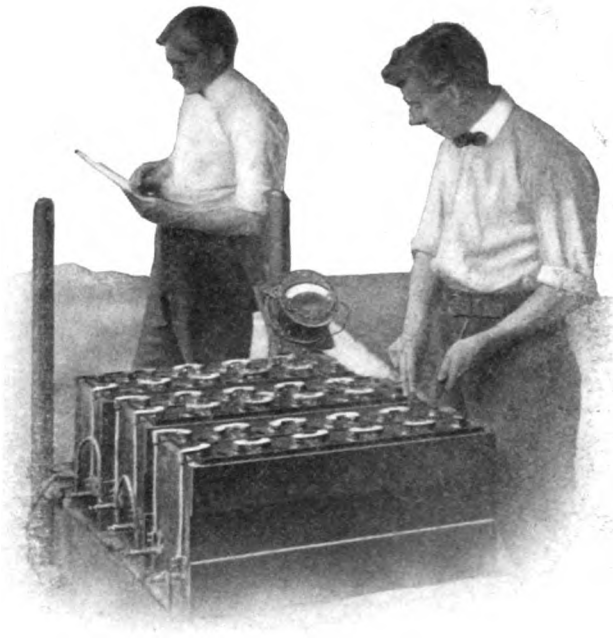

Taking Voltage Reading of Individual Cells.

Taking out an Element to Examine for "Mud" or Sediment.

of charge. The number of rheostats which will be required wholly depends upon the number of vehicles which are to be charged at one time. Thus, for example, a stable in which 40 electric wagons are housed might, if the service was operated night and day, get along with half as many rheostats, while if the vehicles were only employed in the day time, and charging was done at night, more rheostats would necessarily be required. Where the current supplied by the light companies is not direct 110 volts, they will often furnish the necessary equipment to transform the current and give the correct voltage. Rheostats may be put back of each charging plug, and the man in charge of the stable may make the round of vehicles occasionally in order to read meters, or a switch board may be placed at some convenient central point in the stable, so that this work may be performed with little exertion. Such current is bought by meter measurement, by the kilowatt, at a flat rate.

A number of concerns now employing electric power wagons generate their own current at a cost of 2 cents per kilowatt, using cheap gas.

The cleanliness, compactness, reduced risk from fire, and low cost of electric wagon stable operation combine to give it advantages not possessed to the same degree by a stable of any other kind.

Lead Burning of Connecting Straps.

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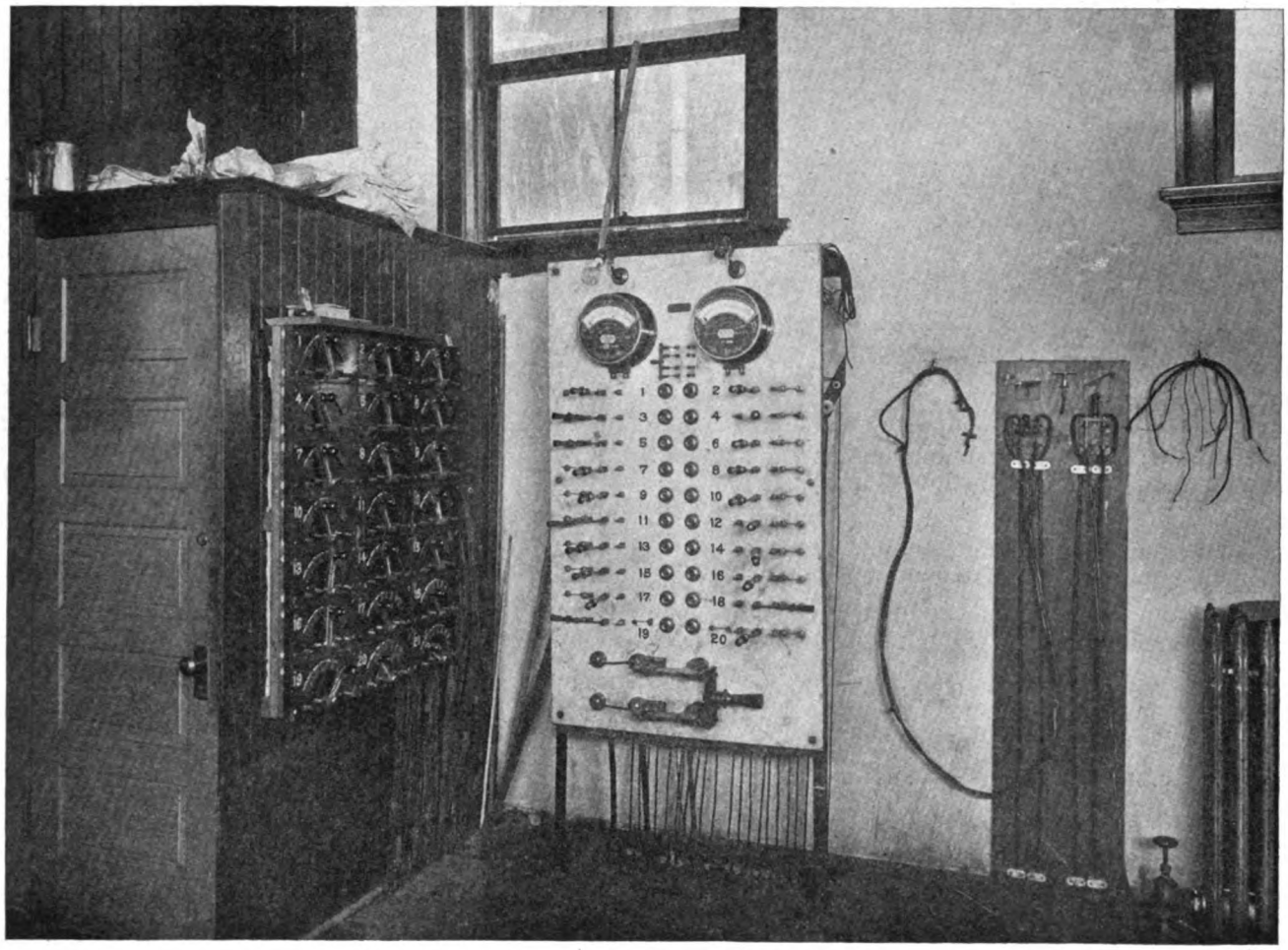
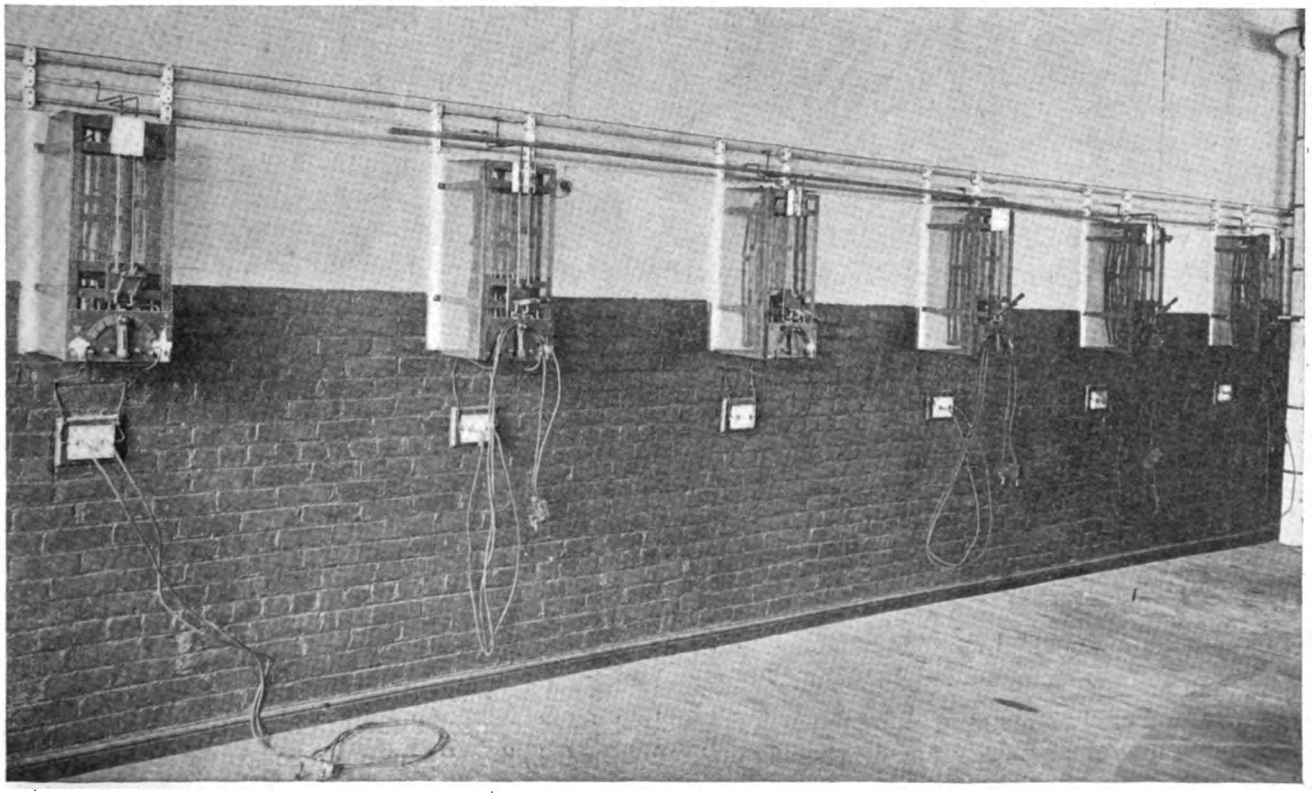
Features of an Electric Stable



SWITCHBOARD WITH RHEOSTAT PLUGS



COMPACTNESS—A WAGON TO EACH RHEOSTAT

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Municipal Vehicles

Record of Some Fine Performances of Motor Wagons in Municipal Service Abroad

YEARS ago, before the economic advantages of the industrial automobile were widely attested, municipal engineers in this and other countries declared in many a congress that the heavy-footed and soiling horse was an unsanitary nuisance and on that account should be kept off the streets. At one gathering in 1898 this sensible resolution was adopted:

"That this conference of municipal engineers, assembled in conjunction with the Congress of the Sanitary Institute, is of the opinion that the extended use of motor vehicles should be encouraged by county, municipal, urban and other authorities, in view of the fact that the free employment of such vehicles will contribute to the general improvement of the sanitary conditions of streets and towns; and this congress recommends that the Sanitary Institute make known this opinion as widely as possible."

As an example of the foul street conditions which people in a large city are accustomed to endure, consider London, with its 81,200 horses stabled in the city proper. Veterinary and health authorities agree that the daily excreta of each animal will average 30 pounds of solid and about five quarts of liquid matter. Assuming that the excrement deposited in the streets is one-third solid and one-fourth of it liquid matter, we arrive at the conclusion that 362 tons of solid and 23,337 gallons of liquid horse manure are deposited in the streets of London every day, while the daily amount of manure deposited in stables is over 725 tons of solid and 76,131 gallons of liquid matter.

THE FILTH OF A BIG CITY

The filth and costliness of horse traffic plead powerfully for its abandonment. By the way, it must be remembered that the city of London does not include the whole area that is usually implied by its mention. Outside of the city proper there is a large district which is also under corporation control, and the horse filth daily deposited there is even greater than that described above.

But it is not alone because health conditions would be vastly improved by the retirement of horses from streets that municipal authorities are now displaying keen interest in the use of power wagons. There is decided economy in their employment—a statement, unhappily, more fully corroborated by foreign experience than domestic. Great Britain, France and Germany are far more enlightened than America in the use and economy of municipal motor wagons. Streets are watered and brushed, supplies are transported, dust and garbage removed, and repairs made to damaged electric wires by means of motor vehicles owned by thirty odd municipal corporations in England. In one instance a municipality even operates motor buses.

MUNICIPAL HAY AND GRAIN WAGON

The whole world has heard of Glasgow's thrift in municipal management. The city has used power wagons since 1904, hauling hay and grain from the docks and railways to the municipal granary, and distributing the feed to the municipal stables. The vehicles are too low powered to collect garbage as cheaply as such service can be performed by horses, although originally they were purchased for that purpose.

Aberdeen is another Scotch city which uses the power wagon. Its street railway lines are owned by the municipality. The electrical engineer in charge, speaking of the value of the motor tower wagon, is quoted as saying: "This department purchased a 2-ton lorry chassis fitted with a four-cylinder 20 hp. engine at, roughly, a cost of $3,500, and upon this we constructed, with our own workmen, a tower for inspection and repairs to our electric tramway overhead equipment. It is necessary for any system of electric tramways of any size to have an emergency tower wagon standing ready for any breakdown which may occur to the overhead equipment. While these breakdowns are rare in a well-equipped system, it is impossible to guard against all classes of breakdown. Take the case of a large bunch of telephone wires falling and burning through the guard wire. The alternative to having a mechanically-driven vehicle is to keep a pair of fast horses always ready for this emergency work. Due to our having obtained a motor tower wagon at the commencement, I am not in a position to state what economies we have made by adopting the gasoline wagon instead of horses; but the saving is considerable. The cost of repairs to our motor wagon is trifling, but up to the present—and we have had it installed some three years—the annual expense entailed has been for one new tire, due to the old one being badly cut. We use solid tires. We can obtain a speed of 12 miles an hour on the level, and the average load, with three men and the necessary tools and appliances, is over two tons. We use no trailer. We have this wagon for transferring men and tools in the case of a broken axle of a tramcar, and have found the same of considerable service in connection with this form of trouble. Roughly speaking, the annual cost of up-keep, including interest, depreciation, wages, repairs, insurance, stores and sundries, is about $600. It should be borne in mind, however, that the drivers are engaged on street car repairs during the whole of the time they are in the sheds; only a portion of their wages, therefore, are charged against the motor wagon."

MUNICIPAL MOTOR TOWER WAGON

Bradford is a singularly progressive English manufacturing city. The general manager of its street railway lines, which also are owned by the municipality, testifies as follows in praise of the efficiency and economy of the motor tower wagons employed: "At present this department has in use two tower wagons, one of 6 hp. and the other of 14 hp., one of which, however, is about four years old and another about three years. The cost of the 6 hp. wagon was about $2,500, and of the other about $3,550, but, of course, these prices are somewhat in excess of what similar wagons could be bought for nowadays. They are used for erecting, maintaining, and repairing overhead

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equipment. I regret that I am unable to give any idea of the approximate economy effected by the use of these wagons; but that it is very considerable will be inferred when the distance they can cover in a limited time is taken into consideration. As to whether motor wagons have proved inferior to horse haulage, I can emphatically say 'No,' as they are well suited for any class of work a horse can do; in fact, on heavy gradients, and for frequent starts, as is necessary in examining overhead wires, they are far in advance of horses. I am unable to give any idea as to the cost of repairs for these wagons per annum, nor would it, perhaps, be quite fair to make a comparison between these motor tower wagons, which are, as previously mentioned, several years old, and more modern and more powerful engines which can be obtained nowadays. Solid 6-inch rubber tires on the back wheels, and 4-inch on the front wheels, have proved very satisfactory. The average load, including weight of tower wagon, engine, chassis, and repair material carried, is about 3 1-4 tons, and this is also about the maximum. The average weekly mileage for each wagon is about 100. As this may appear very small, it would be as well to point out that these wagons are used in the daytime for emergency and breakdown calls, very much in the nature of a fire engine, and, consequently, some days they are scarcely required at all, the mileage stated being principally made up on night work. It will, of course, be obvious that these wagons are used for the carriage of men, tools, etc., to various parts of the tramway system. I should have no hesitation in recommending the purchase of vehicles of this class should any be required in the future."

MUNICIPAL GENERAL UTILITY WAGON

The following report from the engineer of Burnley, another English town, is interesting, as showing the highly profitable work of which even a discarded type of steam wagon is capable: "The motor wagon has been in use since June, 1902. It cost $3,000. The frame of the vehicle is of channel steel 6 inches by 2 1-2 inches by 2 1-2 inches by 3-8 inch. The wheels are of the gun-carriage type, the front wheel tires being 5 inches wide, and the back wheel tires 10 1-2 inches. The length over all is 19 feet 6 inches, and the width over hubs 6 feet 6 inches. The tare weight, exclusive of water and fuel, is 5 tons, and in full working order 6 tons. The internal measurement of the wagon is 12 feet by 5 feet by 1 foot 6 inches, and when carrying sand or ashes the depth can be increased by sideboards to 2 feet 6 inches. The load usually carried is from 4 1-2 to 5 tons. The height of the wagon bottom from the ground is 3 feet 6 inches. The work consists of hauling ashes, coke, and stone, or any material used in streets or roads. It is also found useful at times for shunting railway cars on our private sidings. The wagon requires a hard, well-formed road. The district travelled is hilly, with a considerable proportion of macadamized roads. If the roads are at all slippery or greasy, it is necessary to have a man in attendance, in addition to the driver, to throw gravel or some gritty substance under the wheels, and this has been so frequent that the motor wagon is never sent out now without the second man. This necessity for a second man might probably be largely obviated if some mechanical appliances were fixed to the wagon, enabling the driver, by using a foot lever, to scatter the grit substance under the wheels. A considerable item is that for repairs. At least $5 per working week is expended on repairs, and, in addition, the wagon is laid up 10 per cent of its time while repairs are being carried out. It is also stopped about 7 per cent of its time for cleaning. The driver is a fairly skilled workman, and is able to do the ordinary repairs. He, however, assists in loading and unloading when not engaged with his engine. The wagon works nine hours per day and the driver 10 hours. It is stabled on Saturdays for cleaning. During three years the journeys of the motor wagon have, as far as possible, been 1 1-2 to 2, and occasionally 6, miles out from the depot (320 journeys of the latter distance being travelled). The cost of hauling one ton a mile by the motor wagon is $2.02, as against $2.50 with horses, assuming that a horse, cart, and driver be hired at $1.86 per day of nine hours. This includes the out and in journey, and the time for loading and unloading. We find that for long journeys the motor wagon is more economical than horse haulage, but in short journeys it is considered of no advantage, owing to the time taken up in loading. Appended is a statement of the work done and the cost of same during the three years, and I may point out that in making up the cost of haulage by the motor wagon I have allowed the sum of $463.32 per annum for interest and sinking fund, the interest being at the rate of 3 1-4 per cent, with repayment spread over 7 years:

WORK DONE BY WAGON IN THREE YEARS

Hauling	6,060	hours
Shunting, at 60 cents	283	"
Private work, at 60 cents	121	"
Under repairs	869	"
Under cleaning	573	"
Not working, ground slippery	204	"
Total tons carried	11,258	
Total miles travelled	10,250	
Total tons carried one mile	23,157	

At an average cost of $2.02.

THREE YEARS' COST OF OPERATION

Repairs	$ 672.00
Fuel	195.00
Oil for engine	28.80
Wages—1 man	1,012.00
Wages—1 man	797.36
Oil for bearings	39.00
Insurance	28.80
Interest and sinking fund on $3,000 at 3¼ per cent for seven years	1,389.96
	$ 4,162.92
Less shunting and private work	242.40
Cost of hauling 23,517 tons by motor wagon at $2.02	$3,920.52
Cost of hauling 23,517 tons by horses at $2.50.	$4,938.56
Being a saving by the motor wagon of	$1,018.04

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MOTOR WAGON FOR REFUSE COLLECTION

In Bootle, another English town, the steam wagon and trailer are used by the municipality for watering and brushing of streets and collection of horse refuse, the trailer being used for refuse collection work. The trailer covers 60 miles each week, but the street cleaning vehicle covers 200 miles each week.

MUNICIPAL SAVING OF 35 PER CENT

Norwich is another large English city which employs the steam wagon. Its city engineer recently reported as follows to the corporation council: "As instructed at your last meeting, I have prepared an account showing the cost for one year of motor haulage as compared with horse and cart, and a further statement showing the cost per ton mile of haulage by steam wagon as compared with that by horse and cart. The cost of running the steam wagon for a year, including wages, oil, packing, waste, water, boiler insurance, rent of shed and lighting thereof, repairs and depreciation (which I have estimated at 30 per cent per annum) is $1,578.64. Ditto for one horse and cart, but allowing 12 1-2 per cent for repairs and depreciation, $521.04. A week's work of the steam wagon when engaged in hauling macadam comprised 340 ton miles; the cost thereof worked out at 8 cents per ton mile. A week's similar work with horse and cart, between the same points, comprises 81 1-2 ton miles at the cost of 12 cents per ton mile. From these figures it will be seen the cost of haulage with horse and cart is 35 per cent in excess of the same work with your present 4-ton steam wagon. With an up-to-date 5-ton steam wagon the total annual cost would be probably less than that of the present 4-ton steam wagon, whilst its working capacity would be 25 per cent greater. In the case of a 5-ton steam wagon the cost per ton mile for haulage similar to that herein dealt with will be about 6 1-2 cents, whereas the cost of identical work with horse and cart is 66 per cent greater. If, instead of dealing with the corporation's own horses, a comparison is made with your contract ton mile haulage, which, for the distance in question, works out at 14 1-2 cents per ton mile, the cost thereof will be found cent per cent in excess of haulage with a 5-ton steam wagon, or 20 per cent in excess of the cost with the corporation's men, horses and carts. Cartage from the gravel pits under your gravel contract would for the distance amount to 16 cents per ton mile, or about one cent per ton in excess of the ton mileage contractor's charges which we have to pay. For certain work, quite apart from the question of cost, the motor offers very great advantages, notably for the haulage of fuel to the Asylum and Isolation Hospital, to which institutions my department has to deliver more than 1,000 tons per annum; also in the watering of suburban roads. With horse-drawn water carts it is practically impossible to water these roads, the cost being so great in consequence of the length of haul and the comparatively small loads which can be taken. During the past summer, when the steam wagon could be spared from coal or macadam haulage, it has been employed on such watering; but, in consequence of the other demands upon it, only very intermittently. Such services as it did render, however, in this connection proved valuable in preventing the breaking-up of roads in dry weather. It would be very advantageous if I were in a position to more regularly water these roads. It is of great convenience to be in possession of an appliance, such as a motor wagon, which enables the rapid discharge of cargoes, seeing that most macadam and a very large proportion of the coal used by the city comes by water, and if craft are delayed the demurrage charges are very heavy."

ANOTHER EXAMPLE OF ECONOMY

Another, and final, demonstration of the municipal economy to be gained through the use of power wagons is furnished by the city of Westminster, whose engineer has charge of three motor vehicles, costing about $6,750, for watering streets and collecting garbage. This official reports as follows: "All the vehicles are provided with interchangeable bodies and solid rubber tires. One wagon was purchased for street watering exclusively; in the case of the other two, the purchase was to enable the house dust of the district, large in quantity, though light in weight, to be speedily removed from the street kerbs before ten o'clock in the morning, and, subsequently, by an interchange of bodies to continue in street watering during the rest of the day. As to the advantages to be obtained from the use of motor wagons, much, I believe, depends upon the need for their constant use both day and night; in this case they may reasonably be considered to take the place of three sets of horses during the 24 hours, and, if a motor wagon has a capacity in van loads of six cubic yards, approximately double the size of the ordinary dust vans, with a trailer of a further six cubic yards, making in all 12 cubic yards, it can be seen that under favorable circumstances the use of such a motor day and night would take the place of some 12 horses. Under these favorable circumstances there would be little doubt that the use of the motor wagon would be cheaper than horse traction, but there are also advantages of employing motor wagons on many considerations than those of economy. They are always ready for their work, they do not produce dirt in the streets which horses produce, and they can pass in crowded traffic with greater freedom, and can apparently be guided and turned more expeditiously. With regard to the use which your committee might make of additional motor wagons, possibly that of street watering in the daytime and at night is the greatest, unless a more extended collection by day of house refuse is made in the morning from the street kerbs. It must be obvious to anyone that the use of a motor wagon stopping at premises where a weekly collection is to be made by shovel and basket, entailing a wait at each place, would be probably a wasteful expenditure of power, but for expeditious collection of house dust from receptacles placed on the kerb, or from conveniently accessible positions on private premises the use of the motor wagons offer advantages far beyond those of the ordinary dust cart. Having been directed particularly to refer to the work done by the motor wagon in street watering, as compared with the horse water van, I beg to report that the capacity of the motor wagon tank is about 860 gallons; that of the horse-drawn wagon about

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400 gallons. In traffic the speed of the motor water wagon averages 6 miles per hour, as compared with 2 1-2 to 3 miles per hour of the horse wagon, and I find that, taking into consideration the time saved in the smaller number of occasions for stopping for filling purposes, one of the motor wagons can keep damp as great an area, at least, as two horse-drawn wagons, and in large areas one motor wagon would be equal to three horse wagons. In accordance with your directions to give the comparative cost of horse power and motor power for municipal work, the following is an estimate of the cost prepared in 1901, modified after an experience of four years' working:

MOTOR WAGON COST PER ANNUM

Interest and return of capital, spread over ten years	$395.04
Fuel	528.00
Wages, two drivers at $8.88 per week	923.52
Repairs (working night and day) say, 20 per cent	672.00
Lubrication, etc.	96.00
Insurance	15.36
	$2,629.92

"Equivalent to, say, $7.20 per day by motor power (for street watering or for watering, dust collection and flushing). It will be seen that the above provides for working in two shifts of 10 hours each per day of 24 hours, and on the modest assumption that a motor street watering van is equal to two and a half horse street water vans (the surveyor to the St. Pancras Borough Council is represented in the Press to say that under certain circumstances a motor van, very little bigger than the city council's motor vans, would equal five of the present horse water vans of that borough) the cost of the work by horse power will be as follows:

HORSE WATER WAGON COST PER ANNUM

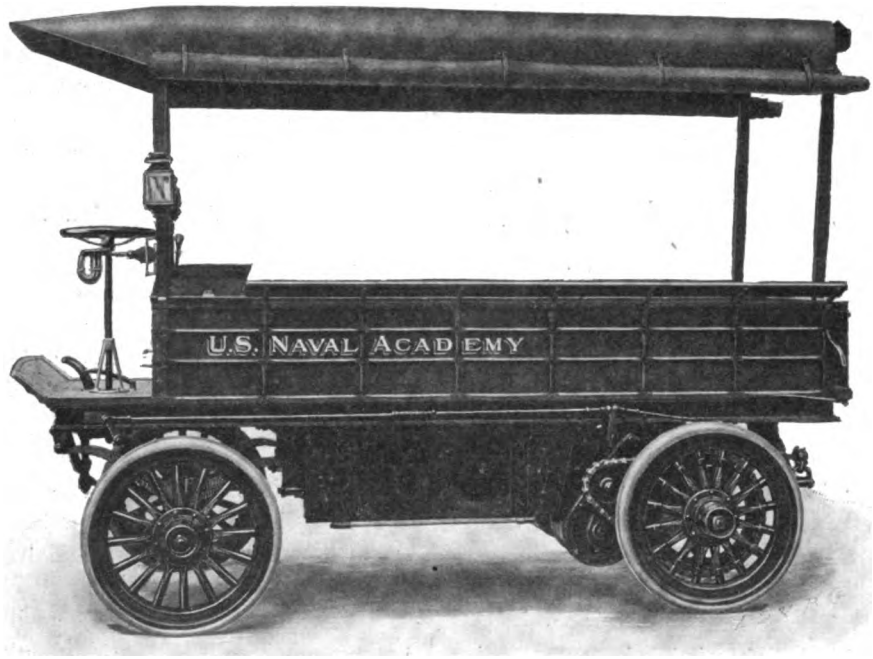
"From prices of competitive tender, seven firms tendering:

Two shifts of 2 1-2 horses, carmen and harness (five horses, etc.) at $2.28 per day—per annum	$4,161.00
Interest and return of capital, etc., of van at $21.60—say three vans	64.80
	$4,225.80

"Equivalent to, say, $10.56 per day by horse power. Taking, however, the work actually performed by the motor wagon of the city council in clearing house dust from the street kerbs, from 6 o'clock a. m. to 10 o'clock a. m.; in street watering from 10 o'clock a. m. to 7 o'clock p. m., and in street flushing from 11 o'clock p. m. to 6 o'clock a. m. (two shifts of 10 hours per day) the estimated cost for comparison, by horse power, would be:

	PER DAY
Dusting—4 hours, 4 horses and vans at 24c per hour	$3.84
Street watering—9 hours, 2 1-2 horses and vans, at, say, 24c per hour	5.40
Street flushing—7 hours, 2 1-2 horses and vans, at, say, 24c per hour	4.20
20 hours (two shifts) per day by horse power, equivalent to, say	13.44

"NOTE.—In dust collection four ordinary horse dust vans have the same capacity as one motor wagon and trailer (12 cubic yards)."



M'Crea Electric Truck in Use at U. S. Naval Academy.

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Gasoline Wagon Operation

Tips to New Drivers and Care Takers About Matters Likely to Escape Their Attention

IF, after running a vehicle for a time slowly, with the engine throttled down, it becomes necessary to increase the speed and the throttle is opened wide, the engine may stop instead of increasing its speed. Or it may continue to run slowly for a few revolutions (called staggering), not answering at once to the opened throttle. This is what is termed "choking," and is due to too much gasoline being supplied when running at slow speed, the suction not being strong enough to lift the gasoline into the engine. But when the throttle is opened, increasing the suction so that the surplus gasoline accumulated in the carburetor is raised to the engine, then this mixture is too rich and gives slow combustion. The way to correct this is to reduce the supply of gasoline by decreasing the size of the jet. This may make the mixture weak at the slow speed, in which case a smaller aspiration or choke tube should be used around the jet. If the engine chokes, with the mixture weak, instead of rich, and gasoline is dripping from the carburetor, then heat should be supplied to the carburetor either in the incoming air or else by passing the exhaust gas or cooling water through the carburetor jacket, as these symptoms show that the gasoline is not vaporized on account of it being too cold, and therefore cannot be lifted. Both above troubles can be corrected to a certain extent, but in a wasteful manner, by drilling small holes at points where gasoline could accumuulate, so that it can drain out, care being taken not to make the holes too large or a weak mixture when the engine is throttled down will result.

OTHER CAUSES OF "CHOKING"

Choking may also be due to the joint leaking where the jet is screwed into the carburetor casting. If the gasoline continues to drip from the carburetor when the engine is stopped the float level is too high, the gasoline running over the top of the jet. The float may leak gasoline into its inside, making it too heavy, or else the float valve is leaking and does not shut off the gasoline. This may be caused by dirt, or the valve may be rusted with standing. It is advisable, when the car is not to be used for a while, to drain the gasoline out of the float chamber and replace it with a few drops of oil, which will keep the valve from rusting.

THE FUNCTIONS OF A LUBRICANT

One of the functions of a lubricant is to overcome or neutralise accidental variations of the smoothness of surfaces. Although almost infinitesimal in magnitude, they cause variations in the friction, which are always tending to produce overheating, and it is solely a matter of chance when these tendencies preponderate over the lubricating effect of the oil. A light oil lubricates as well as a viscous one when all is smooth, but when a minute irregularity occurs, such as grit or rough places on the surfaces, heat is generated locally, the oil becomes too thin, and there is a risk of seizure taking place. By the use of a plentiful supply of a viscous lubricant this risk can be considerably reduced. A new engine under-lubricated will seize much more readily than one well run. There are three other conditions to meet which a viscous lubricant is necessary, viz., great pressure, slow speed, and high temperature. Seizing can always be traced to a failure of the lubricant to keep two metal surfaces adequately separated by a film of oil. Either the oil may be too thin, or the pressure between the surfaces too great, or there may be no lubricant there at all. When the two surfaces come into close contact under considerable pressure much work has to be done to get one to slide over the other; the work expended in overcoming the friction is translated into heat, and the heat thus produced raises the temperature of the bearing, and the molecules of metal at the two surfaces, spurred into great activity, diffuse. This tendency to diffuse or weld is so great that, when two metals with carefully cleaned and polished surfaces are very strongly pressed together and left for several weeks at the atmospheric temperature, molecules from one are found diffused throughout the other. This migration is immensely facilitated by a rise in temperature equivalent to an increase in the velocity of the molecules. When the seizing is incomplete, and the metals continue to slide over one another, the surfaces, especially of the softer of the two, are scored, and, even if checked at this stage by stopping the engine or by a copious supply of oil, the repair of the damage is an expensive matter. Scoring and seizing are facilitated by high temperature, high pressure, and close fitting; it must be remembered that a close fit at a low temperature becomes a much closer fit at a high temperature. Hence we arrive at the main features determining a suitable lubricant; it must withstand the maximum temperature which it will have to meet, and preserve, as far as possible, an unbroken film beween the sliding surfaces.

GRAPHIC TEST OF LUBRICANT VALUES

The following experiment shows in a striking manner the difference between a thick and a thin oil. A plug and ring are taken and thoroughly cleaned free from oil and grease, when it will be found that the plug, which should be a close fit in the hole, will not go in without a tap from a mallet. On greasing the plug with a little thin oil it slips in readily, and can be easily revolved in the hole several times; but in a few seconds, owing to the lubricant's being squeezed from between the surfaces by the pressure, the plug seizes and has to be knocked out. The plug and ring are again well cleaned, and this time greased with thick oil. The plug will slip in just as easily as before, but it will be more difficult to revolve owing to the greater fluid friction of the lubricant, and, further, owing to the lubricant's greater resistance to pressure the plug may be revolved much longer without seizing.

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Wagon Owners' Association

Examples of Substantial Benefits Which Have Been Gained Through Organization

WHILE the need for organizing power wagon users for purposes of offense and defense is not at this moment strikingly obvious, still the time is not distant when the formation of a body like the Motor Van, Wagon and Omnibus Users' Association of Great Britain will become a duty of the first importance.

The administrative acts of the association referred to are so useful and so little known that it is well worth while to set forth the objects of the organization:

(*a*) To resist undue restrictions being placed upon the use of motor vehicles by authorities having jurisdiction over roads, bridges and traffic.

(*b*) To consider any claim from members for financial and legal assistance in respect of actions at law, either civil or criminal, in connection with the use of these vehicles, and, if deemed expedient by the executive committee, to render assistance.

(*c*) To give information and advice, and generally to protect and extend the rights and privileges of users of these vehicles.

(*d*) To originate and from time to time promote improvements in the laws and regulations directly or indirectly affecting self-propelled vehicular road traffic, and to support or oppose alterations in such laws and regulations.

(*e*) To represent the views of members before Parliament and the government departments.

(*f*) To collect and circulate to the members any information respecting the use of such vehicles likely to be of service to them.

(*g*) To popularize and assist the development of self-propelled vehicular road traffic.

(*h*) To keep a register of drivers of these vehicles for the purpose of employment.

The fee for membership in the association is $5 per annum. The executive committee is composed of men of large affairs, as will be observed from scanning the list appended:

L. H. Baxendale (Pickford's, Limited).

W. Worby Beaumont, M. Inst. C. E., M. I. M. E.

E. R. Calthrop, M. Inst. C. E., M. I. M. E.

Arthur J. Clay, (Bass, Ratcliffe and Gretton, Limited).

F. C. A. Coventry (Great Western Railway).

Col. R. E. B. Crompton, C. B., M. Inst. C. E.

William Dalziel (The Union Transit Company, and the West of Scotland Carrying Company, Limited).

Jas. L. Farmiloe (T. and W. Farmiloe, Limited).

T. W. Staplee Firth (Solicitor), *ex-officio.*

S. D. Gilbert (London Motor Omnibus Company, Limited).

Dr. Hele-Shaw.

Col. H. C. L. Holden, R. A., F. R. S., M. I. E. E. (Member of War-office Committee on Mechanical Transport).

H. Howard Humphreys, M. I. M. E. (Consulting Engineer).

W. Rees Jeffreys (Secretary Motor Union of Great Britain and Ireland), *ex-officio.*

W. G. Lobjoit (W. and J. Lobjoit and Co.)

H. Thompson Lyon, M. I. E. E. (Chairman, Traffic Committee, Westminster City Council).

Douglas Mackenzie, A. M. I. M. E. (Consulting Engineer).

J. C. Mitchell (The London Road Car Company, Limited).

L. G. Oldfield (London Omnibus Owners' Federation).

Arthur Paterson (Carter, Paterson and Co.)

R. R. Robbins (Wild and Robbins).

E. Shrapnell Smith (Hon. Treasurer), *ex-officio.*

A. A. Campbell Swinton, M. Inst. C. E., M. I. E. E. (The London and District Motor 'Bus Company).

The Hon. Arthur Stanley, M. P. (Chairman, Motor Union of Great Britain and Ireland), *ex-officio.*

W. H. Willcox (W. H. Willcox and Co., Limited).

Three important committees administer the affairs of the association under the supervision of the executive committee. These committees are as follows: Traffic, extraordinary traffic and wagon trials. The work of these committees is supplemented by an advisory board of engineers.

Members of the association are enabled to obtain an unusually low rate of insurance on their vehicles, special terms having been secured from the Car and General Insurance Corporation, Ltd., covering losses due to accidents of all kinds.

The expense to which owners of motor wagons are put in paying for repairs due to bad street and road conditions, is a matter which deeply concerns the association. The slowness of municipal authorities to repair roads which have become impaired, and the consequent excessive wear and tear on motor vehicles, places a very heavy burden upon the traffic which uses the highway. In order to bring municipal authorities to a realization of their shortcomings the association recently requested its members to furnish information upon the following points:

(1) What action your company has taken in the way of approaching local authorities in the matter.

(2) What roads you find are usually abnormally bad.

(3) The number of breakages that your vehicles have suffered, and which you attribute to the irregularity of the paving.

With dependable evidence in hand the association expects to experience little difficulty in convicting the municipal authorities of having neglected plain duties.

The association has had the advantage of legal assistance from automobile associations affiliated with it upon many matters of importance affecting the use of commercial motor vehicles. The activity of the police in prosecutions for the emission of visible gasoline vapor or smoke determined the association to pursue a vigorous course of policy in the interest of its members. As a result ignorant policemen do not now arrest the drivers of every vehicle which occasionally commits a mild offense of the kind described. The legal department also attends to

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claims made by municipalities for extraordinary traffic damages caused by motor vehicles.

As an illustration of the need of legal counsel in suits arising out of municipal claims for extraordinary damages, the case of one member of the association, sued for $1,750 for permitting one of his wagons to impair the highway, may be cited. The suit was contested. Eventually the municipality withdrew its claim and paid the costs of the action. As the case was to have been a test, and if successful other legal authorities in the district were to follow by taking action, the result proved of considerable importance to all users of commercial vehicles.

Considerable information has been given to members in connection with the restricted use of canal and other bridges. The bridge question is one of the most important with which the users of heavy motor vehicles have to deal, and legislation is urgently needed to require the private owners in whose hands many of the bridges and main roads are vested, to bring their bridges up to modern traffic requirements. At the present time they cannot even be compelled to maintain them up to original strength. The association has also pressed on the authorities the necessity for giving its members the right of appeal against official orders to close bridges to motor wagon traffic.

The association is now preparing to undertake the expert examination of members' cars at small cost.

The assistance of the association has been eagerly sought by the war office in connection with certain proposals for utilizing heavy motor vehicles in national defense in time of war. The views of members is being gathered on the subject.

All the leading British firms which employ power wagons are members of the association. Its total enrollment is close to 4,000.

In Chicago, New York and other principal cities, an association of this kind could within a very brief period secure benefits which are not available by any other means. Chicago, for example, has an employers' teaming association which in effect is an operating corporation sustained by many firms, and which at present, by the way, is displaying keen interest in the use and economy of commercial motor vehicles. Primarily this company was formed for the purpose of safeguarding its backers against the evils resulting from teamsters' strikes. With it as a nucleus little difficulty should be encountered in forming a local association similar to that which is so powerfully effective in Great Britain. This local association might well be one of the elements in a national association. Similar opportunity is presented in New York, where hundreds of power wagons are in daily service.

Agitation for the improvement of municipal street conditions and other subjects of even greater importance to tax payers—such for example as the employment of motor wagons in municipal service—might very profitably occupy the attention of the executive committees of such organizations. The merest outline of the work of such organizations is here suggested.

A FOOLISH EXPERIMENT

FOR downright foolishness it would be hard to match the experiment described in the following extract from a recent issue of the Newark *Call*:

One of the most prominent builders of Montclair has brought the automobile into business in a peculiar way, and if his experiment proves successful a number of others are planning to follow his example. John S. Carlson, a builder and mill owner, is the man who has begun to use the automobile as a commercial vehicle, and the one feature of his experiment is the fact that he is carrying out his idea on an inexpensive basis. Instead of going to a manufacturer of commercial machines, Mr. Carlson has purchased a 1904 touring car at a moderate price, and has had it converted into a business machine.

After buying the car Mr. Carlson had the body removed and in its place constructed an ordinary truck body. He is using the car to carry lumber, and finds that it not only saves him time in going to and fro from his mill to places of business, but it also enables him to carry much more material on each trip than he could carry in an ordinary wagon. The whole cost of the converted machine is hardly more than $1,000, and Mr. Carlson feels that it will soon pay for itself. Another interesting feature of the experiment is that Mr. Carlson still has the old tonneau and can easily convert the machine into a pleasure car when he wishes. A number of builders in town are following the experiment with keen interest, and they will undoubtedly follow Mr. Carlson's plan if it is successful.

Mr. Carlson's converted "lumber truck" will cost him dearly before he tumbles to the fact that its most economical load is likely to be shavings. If the chassis has seen the active service in touring which its age would indicate, it must be evident that its working parts are already well worn. Lumber is a "dead" load, worse, in the judgment of experts, than iron or other rigid substances, causing excessive wear on tires and unusual shocks to springs. If this particular "truck" is overloaded, as it is certain to be, and the load is permitted to overhang, its light touring car frame will whip so badly as the vehicle skids that the whole operating mechanism will be wrenched and twisted out of line. If its engine power is such as one might expect in touring car chassis construction the vehicle will be driven at too high speed and its destruction will be speedy. The builders who are alleged to be watching Mr. Carlson as he proceeds in his absurd experiment had better avert their eyes—unless they are maliciously intent upon witnessing his discomfiture.

NAVAL ACADEMY TRUCK

AT the Naval Academy, Annapolis, a two-ton electric truck has been in service for the past year, performing such a variety of work with such unvarying regularity as to make its employment more than commonly satisfactory. The wagon has 42 cells of battery, a 40-mile radius of action, and a maximum speed of 8½ miles an hour. The electrical power plant of the Naval Academy is of a very superior order and current for the wagon is, therefore, cheaply supplied. The wagon replaced two horse-drawn wagons and four horses.

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Railway Independent Cars

Consideration of the Advantages Possessed by Self-Contained Railway Cars in Interurban Service

(BY F. W. HILD, CHIEF ENGINEER SOUTH-WESTERN WISCONSIN RY.)

IN view of the widespread interest in steam railroad circles in the self-power contained car as a means of meeting the increasingly severe competition of the electric roads, it may not be amiss to consider this type of car from the view-point of the electric railway engineer. That the large roads have keenly felt this competition has long been known, and it is now particularly evidenced by the various methods under consideration for meeting it.

The self-powered cars enjoy two advantages which are the sole reasons for the present interest in this type of car. They are the absence of external power transmission circuits and lesser initial investments. It is the purpose of this article to briefly investigate and compare these several factors.

To get down to the gist of the whole problem and to see the influence of the initial investments on a given proposition, we will investigate two cases; the first between the gasoline-electric and the standard electric, and the second between these and steam railway service.

The first proposition contemplates the average interurban condition and may represent the competition between two paralleling roads for the local passenger and light traffic business which is assumed to demand cars at one hour headway from 6 a. m. until 12 p. m. or 18 hours service. The item of cost and maintenance common to both roads will not enter into the present consideration, and we will assume that the general expense of administration, engineering, taxes, insurance, etc., will be the same in both. We will take as service conditions 25 miles of road, stops every three miles and one hour for the run.

The single-phase system is well adapted to such service and will be considered in the following. It would be entirely feasible to operate with a generating plant in the center of the line feeding 6,600 volts directly to the trolley, eliminating high-tension transmission and sub-stations, and thereby effect a saving in the assumed case of approximately $16,000. But it might be necessary because of water supply, coal, etc., to build the power house at one end of the line and thus necessitate a sub-station. In order to be entirely fair to the gasoline-electric car, let us assume this extreme condition.

Two cars will normally handle the service, but for special days requiring half-hour headway and for reserve four motor cars and two trailers will be purchased. The normal daily mileage will be 900.

ESTIMATED COST OF ELECTRIC SYSTEM

Power plant	$ 45,000
One sub-station	2,000
Distribution system	48,000
Four motor cars and two trailers	36,000
Rail bonding	6,250
	$137,250

Interest and depreciation at 10 per cent, $13,725, or $37.60 per day.

ESTIMATED COST OF GASOLINE-ELECTRIC SYSTEM

Four motor cars at $17,000	$68,000
Two trailers at $3,000	6,000
	$74,000

Interest and depreciation at 10 per cent, $7,400, or $20.30 per day.

The maintenance of electric cars and plants per car mile can be gotten fairly well from the many published records, but that of the self-powered cars is at present a matter of guess. It will be taken at four cents per car mile, which is roughly one-half the average maintenance charges of steam locomotives per mile.

OPERATION COSTS

	Gasoline Electric	Standard Electric
Power	7.	1.91
Car crews	3.	1.68
Supplies	.6	.55
Maintenance, equipment and cars	4.	1.5
Maintenance plant and distribution system		.5
Operating cost per car mile, cents	14.6	6.05
DAILY COST.		
Operation	$131.40	$54.45
Interest and depreciation	20.30	37.60
	$151.70	$92.05

Thus, the difference in favor of the straight electric under the conditions assumed would be $59.65 per day or approximately $22,000 per year.

Consider now an existing branch of steam road where the passenger traffic is light. Service must be given even if without profit; indeed many such branch lines are now operated at a loss, so far as the passenger and light traffic is concerned. The problem then is to find the cheapest means of handling the business.

Let us take the same length of line, frequency of stops, etc., as before, but add the condition that four trains each way per day will handle the business. We will assume that the train crews, when not on the passenger runs, are kept employed elsewhere on the system. The steam service would call for two light locomotives and four passenger combination cars. The self-powered and the straight electric would each require two motor cars and two trailers. The trailers would not be used during the normal service, but would have to be purchased and kept to meet the demands of Sundays and special days.

It is assumed that the roundhouse, repair shop and water tanks would about balance the cost of electric carhouse and repair shop. Omitting then, as before, all fac-

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tors of cost and operation common to all three systems, we will have:

ESTIMATED INVESTMENT FOR STEAM SERVICE

Two 45-ton locomotives with tenders,	$16,000
Four passenger coaches	16,000
	$32,000

Interest and depreciation at 10 per cent, $3,000, or $8.78 per day.

ESTIMATED INVESTMENT FOR STRAIGHT ELECTRIC SERVICE

Power plant	$ 27,000
Sub-stations	1,500
Distribution system	48,000
Two motor cars and two trailers	21,000
Rail bonding	6,250
	$103,750

Interest and depreciation at 10 per cent, $10,375, or $28.50 per day.

A plant of this size would not produce power as cheaply as the larger ones. The cost per kw. h. is taken at 1 1-2 cents per kw., whence we have:

Power	3.38
Labor (as before)	1.69
Supplies (as before)	.55
Maintenance (as before)	2.
Cents per car mile	7.62

ESTIMATED INVESTMENT OF GASOLINE-ELECTRIC SERVICE

Two gasoline-electric cars	$34,000
Two trailers	6,000
	$40,000

Interest and depreciation at 10 per cent, $4,000, or $10.90 per day.

The steam train will consist of the locomotive, tender and two cars, giving a train weight of approximately 110 tons. Under the assumed conditions of schedule, stops, weight, etc., such trains will require about 55 watt hours per ton mile, i. e., .0735 hp. per ton mile. In such service the locomotive would burn about 7 lb. of coal per hp. hour, and if this coal cost $2.25 per ton, the train-mile cost would be approximately:

	Per Hour.
Engineer	.35
Fireman	.21
Conductor	.30
Brakeman	.175
	$1.035
Power	6.35
Maintenance locomotive and cars	8.
Supplies	2.
Round house expenses	1.
Train crew	4.15
Cost, per train mile, cents	21.5

The daily operating costs exclusive of those items which are common to all the systems would then be:

	Steam.	Electric.	Gasoline-Electric.
Operation	$43.00	$15.34	$29.20
Interest and depreciation	8.78	28.50	10.90
Total	$51.78	$43.74	$40.10

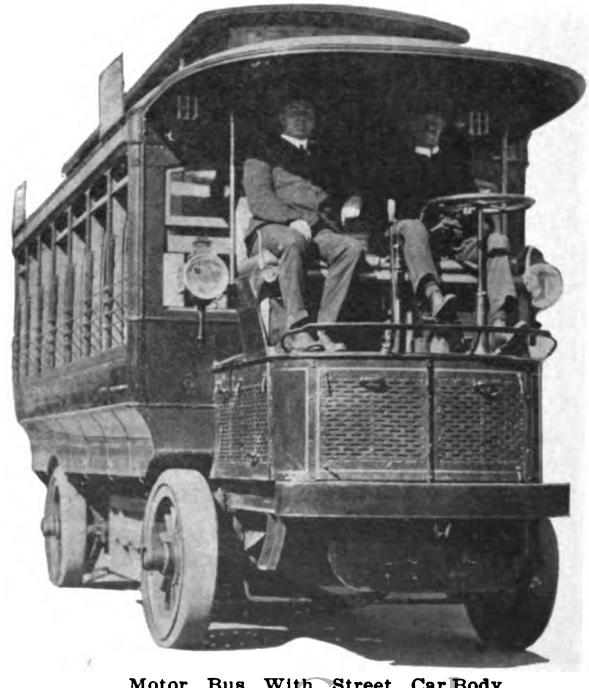
As the same equipment and therefore the same investment would be needed for a few trips more or less, and applying the same unit of operating costs per car mile and the same fixed charges we get the following daily costs:

Round Trips.	Mileage.	Steam.	Electric.	Gasoline-Electric.
Six	300	$73.29	$51.36	$54.70
Five	250	62.53	47.55	47.40
Four	200	51.78	43.74	40.10
Three	150	41.03	39.93	32.80
Two	100	30.28	36.12	25.50
One	50	19.53	32.31	18.20

This brings out clearly that, in the assumed case, the gasoline-electric car is cheapest under six round trips per day, while the electric is cheapest at six trips or more per day.

Managers of steam roads are very conservative, and therefore slow to make what would appear to be radical changes in their equipment. Thus, while they realize the limitations of the steam locomotive in suburban and interurban service, they will, before stringing the trolley wire over their tracks, pretty thoroughly try out the independent motor car which holds out alluringly the suggestion of interurban service without power house, without track bonding, and without external transmission circuit. This try-out will definitely establish the true field of the self-contained car.

In conclusion, the writer believes that the independent motor car will prove a useful transportation medium. Its field, however, will be distinct from that served by the straight electric car.



Motor Bus With Street Car Body.

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GARAGE DESTROYED BY FIRE

TEN light gasoline delivery wagons, stabled on the premises of the Auto Express Company's garage in Detroit, were recently destroyed by fire, entailing a loss of about $15,000. The loss was fully covered by insurance. Many more wagons were slightly damaged. No great loss was caused to the building.

The manager of the company is of the opinion that escaping gasoline fumes from the tanks on the wagons mounted to the roof of the building and, coming in contact with the exposed arc electric lights, caused an explosion. He is confirmed in his belief by the fact that when first observed the flames were destroying the upper part of the building.

The company has contracts with eighty or more merchants of Detroit for the regular delivery of merchandise packages. While the accident has crippled the service, it is expected that in the course of a week or so new wagons to replace those which were burned will be in operation.

This incident freshly emphasizes the necessity for proper ventilation in garages where gasoline is stored. In all probability the fire would not have occurred had there been suitable means for preventing the accumulation of gasoline fumes at the top of the building, which, by the way, was not especially constructed for the purpose it is being made to serve. In all modern garages, ventilation is one of the first considerations for builders.

MEISELBACH HEADS NEW COMPANY

WITH a captal stock of $200,000, a new company has been organized by A. D. Meiselbach for the manufacture of gasoline trucks for express companies, foundries, department stores and grocers. The carrying capacity of the vehicles will vary from 1 to 3 tons. The new company owns a large and well equipped plant occupying 10½ acres of ground located at North Milwaukee. The title of the concern is the A. D. Meiselbach Motor Wagon Company. Mr. Meiselbach is president, Byron R. Godfrey vice president and treasurer, and Charles Rohde secretary of the company.

Demonstrating Economy

Service Record of Packard Truck Hauling Groceries for Reed & Murdoch Co., Chicago

Date	Total Time	Time Stopped	Time Running	Miles	Miles Per Hr.	Gasoline	Oil	Trips	Total Weight	Stops
Feb. 21	9 hr. 10 m.	4 hr. 21 m.	4 hr. 49 m.	39	8	6 gal.	2 1-2 pt.	2	7,800 lb.	16
Feb. 22	8 hr. 30 m.	4 hr. 15 m.	4 hr. 15 m.	43	10	7 1-2 gal.	2 pt.	2	6,500 lb.	13
Feb. 23	8 hr. 48 m.	3 hr. 17 m.	5 hr. 31 m.	38 1-4	7 1-2	6 1-2 gal.	2 1-2 pt.	3	10,697 lb.	20
Feb. 24	6 hr. 56 m.	3 hr. 35 m.	3 hr. 21 m.	25 1-2	7 6-10	5 gal.	1 1-2 pt.	1	3,200 lb.	12
Feb 26	11 hr. 5 m.	3 hr. 15 m.	7 hr. 50 m.	38 5-8	4 8-10	6 gal.	2 pt.	2	7,594 lb.	14
Feb. 27	8 hr. 45 m.	5 hr. 15 m.	3 hr. 45 m.	35	9 4-10	5 1-2 gal.	1 1-2 pt.	2	8,200 lb.	16
Feb. 28	10 hr. 25 m.	5 hr. 2 m.	5 hr. 23 m.	43	8 1-10	8 gal.	2 1-2 pt.	3	11,025 lb.	17
Mar. 1	10 hr. 9 m.	5 hr. 44 m.	4 hr. 25 m.	42 5-8	9 6-10	7 gal.	2 pt.	3	12,500 lb.	19
Mar. 2	8 hr. 44 m.	5 hr. 18 m.	3 hr. 26 m.	34	10 1-5	5 gal.	1 1-2 pt.	2	8,600 lb.	19
Mar. 3	8 hr. 7 m.	4 hr. 52 m.	4 hr. 15 m.	40	9 7-10	7 gal.	2 pt.	2	7,050 lb.	14
Mar. 5	9 hr. 46 m.	6 hr. 2 m.	3 hr. 44 m.	43	11 7-10	7 1-2 gal.	2 1-2 pt.	2	8,177 lb.	13
Mar. 6	9 hr. 20 m.	5 hr. 13 m.	4 hr. 7 m.	37 7-8	9	6 gal.	1 1-2 pt.	2	8,439 lb.	16
Mar. 7	10 hr. 36 m.	5 hr. 30 m.	5 hr. 6 m.	34 3-4	6 4-5	5 1-2 gal.	1 1-2 pt.	2	7,500 lb.	18
Mar. 8	9 hr. 17 m.	5 hr. 21 m.	3 hr. 56 m.	33 1-4	8 1-2	5 1-2 gal.	2 pt.	2	7,950 lb.	15
Mar. 9	9 hr. 59 m.	5 hr. 19 m.	4 hr. 40 m.	39 5-8	9 2-3	6 gal.	2 pt.	2	8,100 lb.	21
Mar. 10	7 hr. 34 m.	3 hr. 59 m.	3 hr. 35 m.	32 3-8	10 6-10	5 gal.	1 1-2 pt.	2	7,200 lb.	16
Mar. 12	10 hr. 20 m.	6 hr. 6 m.	4 hr. 14 m.	30	7 1-4	5 gal.	3 pt.	2	8,000 lb.	14
Mar. 13	11 hr. 57 m.	5 hr. 51 m.	6 hr. 6 m.	50 7-8	8 1-2	8 gal.	4 pt.	3	9,650 lb.	21
Mar. 14	8 hr. 28 m.	5 hr. 59 m.	2 hr. 29 m.	19 3-4	9 1-2	2 1-2 gal.	3 pt.	1	4,200 lb.	9
Mar. 15	9 hr. 54 m.	5 hr. 43 m.	4 hr. 11 m.	33 1-4	8	6 gal.	3 1-2 pt.	2	8,000 lb.	17
Mar. 16	10 hr. 38 m.	4 hr. 16 m.	6 hr. 22 m.	39 3-8	6 1-4	6 gal.	2 pt.	2	4,200 lb.	12
Mar. 17	6 hr. 55 m.	2 hr. 25 m.	3 hr. 30 m.	30 1-4	8 1-2	5 gal.	1 1-2 pt.	2	5,400 lb.	16
Totals . .	205hr. 23m.	106hr. 23m.	99 hr. 0 m.	803 3-8	*8 1-9	131 1-2 gal.	47 1-2 pt.	46	180,682 lb.	348

*Average.

Gross Earning = $237.02
Daily Mileage = 36½ miles
Gasoline Mileage = 6 1⅛ miles per gal.

Average Load = 3914 pounds
Fuel cost per ton mile = 1⅘ cents
Fuel cost per mile = 2⅗ cents

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HARD TIMES FOR CABBY

"LOTS of the cab drivers have struck hard times," remarked the keeper of a boarding stable who does not employ cabmen himself, but is familiar with the fraternity. "The public automobiles are knocking them out, and many find it difficult to pay expenses and make any sort of a living. I am not speaking of the men who are paid wages by livery stables or large cab proprietors and have regular stands, but of those who own or hire their rigs and cruise about, picking up fares where they can. It is getting worse and worse for them. For 'park calls' or drives through Central park and other calls which used to mean good money, visitors in the city and New Yorkers, too, now hire an automobile when a cab used to be the regular thing. I don't see what a good many of the independent cabmen are to do except to get out of the business. By a year from now I don't believe there will be more than a third of them left."—*New York Post.*

♣

Power wagons will soon be employed by the Rescue Copper Company in New Mexico, for the transportation of supplies between Tucson and Ajo, in New Mexico, which are about 50 miles apart.

♣

It is proposed to operate an automobile stage line between Carrollton and Madison, Indiana.

Motor buses can be hired in London from $45 to $70 per day, depending upon the mileage required of the vehicle, and its carrying capacity.

♣

The Berlin Electric Cab Company is doubling its capital stock, raising it from 1,500,000 marks to 3,000,000 marks.

♣

The service of the railway operated by the Federated Malay States is to be supplemented by three motor omnibuses which have been shipped from abroad.

♣

A 2-ton electric truck has been shipped from this country to England for use in the service of the Great Western Railway Co.

♣

The chief executive officer of the Daimler Motor Company has announced that at no distant date the Daimler works will be turning out large numbers of commercial motor vehicles.

Pressed Steel Truck Frames
The
PARISH & BINGHAM CO.
CLEVELAND, OHIO

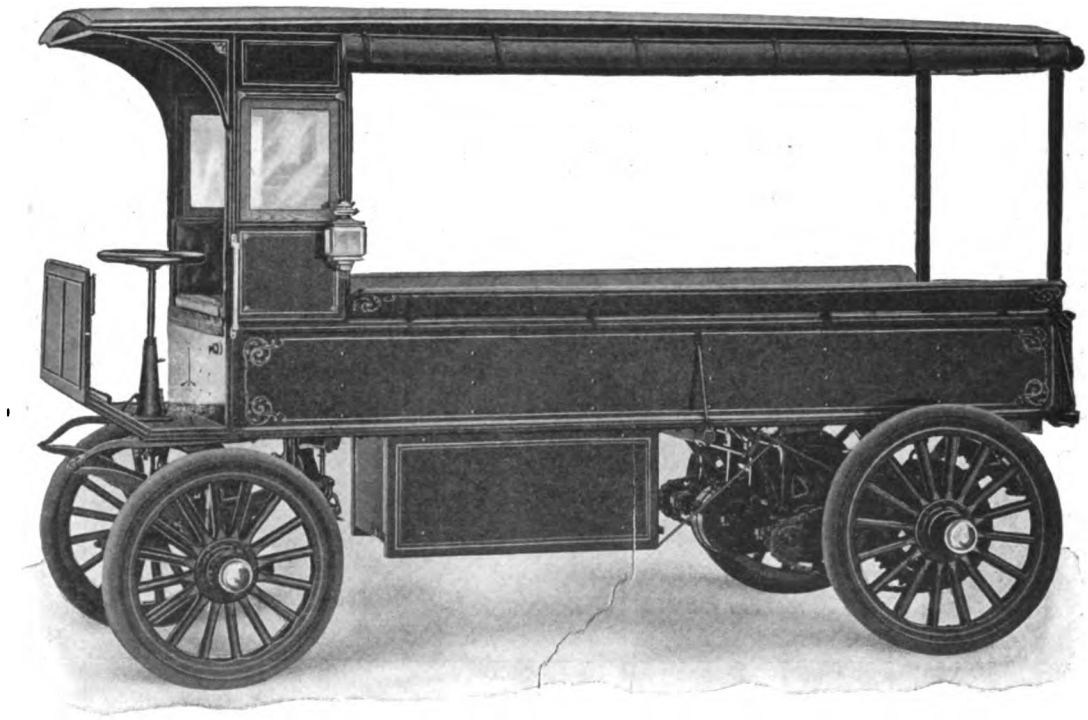
The Commercial Truck
cannot afford to have anything but the BEST. The ignition is undoubtedly the heart of the power wagon.

The Splitdorf Coil
is universally acknowledged the BEST. You cannot afford experiments.

(Made in America since 1858 in the Splitdorf Laboratory).

C. F. SPLITDORF
17-27 Vandewater St. New York N. Y.

"DIAMOND" CHAINS
Outnumber, Outwear and are Stronger than Others
WRITE FOR CATALOGUE
DIAMOND CHAIN & MFG. COMPANY
INDIANAPOLIS, IND.



PITTSBURG 6000 POUND ELECTRIC COMMERCIAL VEHICLE

JAMES MACNAUGHTAN COMPANY, Buffalo, N. Y.
EXCLUSIVE SALES AGENTS

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THE POWER WAGON

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A Senseless Custom

Power Wagon Makers Object to Lengthy Demonstrations as Being Costly and Valueless

CERTAINLY it cannot be complained that manufacturers have thus far hesitated to expend very considerable sums of money in order to demonstrate the superior economy of power wagons in the transportation of city merchandise. This burden, however, which at the outset was voluntarily and patiently endured, has of late developed hardships against the continuance or extension of which there is open rebellion.

It is some years since the economy of the power wagon was fully demonstrated in such service as is usually required of horse-drawn vehicles. The truth of this is well attested by the ledgers of concerns which have kept accurate account of the operating costs of both power and horse-drawn wagons. This information, however, not being readily available to establishments which, having but recently had their attention directed to the economic possibilities of the power wagon, encourages them to believe that they are pioneers in its employment, and therefore entitled to costly and lengthy service demonstrations. Evidently enough publicity has not been given to the fact that some of the largest concerns in this country—notably those whose business exclusively consists in the sale of transportation facilities—have long since reached the conclusion that the horse is far inferior to the power wagon in ordinary service.

Demonstrations, as a rule, merely determine the adaptability of power wagons for any given service in which they are being tested. The great majority of demonstrations, however, are utterly valueless since they are conducted without regard for the extreme usefulness of the motor vehicle. To take a couple of horse-drawn wagons off a route, and for a brief while put a power wagon to work in performing their duties, obviously compares the lowest economy of the power wagon with the maximum economy of the horse wagons. Definitely to ascertain the economy of the power wagon, it would be necessary, first of all, to re-arrange the route so that it would never have an idle moment within the period when business could be transacted.

Some trade expressions of opinion on this highly interesting and important subject are subjoined:

A GUARANTEE THAT SHOULD SATISFY BUYERS

We do not believe in long demonstrations. They are invariably taken advantage of by the parties to whom they are made. We were told by one of the officials of a company in this city that agents for commercial vehicles insisted upon making long demonstrations, and that his firm had decided to use power wagons in this service as long as the agent would stand for it, because their earning power was greater than the teams they employed, and their daily sheets showed a very large net earning for the company, the agent receiving no returns. To use his own words: "Why shouldn't we take advantage of this and let them go out and earn money for us? That's our business." Said company having no idea of purchasing these vehicles.

We believe that a motor vehicle hauling a certain load a certain distance within a given time, at an established cost per ton mile, fully demonstrates its efficiency even if the time consumed be not more than two hours. We understand, however, that this does not demonstrate the staying qualities of the vehicle. Neither would six months' demonstration. The proposition we are making to our prospective customers is as follows:

1st. A straight year's structural guarantee.

2nd. The refunding of purchase price of any vehicle proven commercially impracticable. The standard of practicability to be the ability of the truck to haul its maximum load 100 miles in 16 hours continuously.

3rd. A contract to maintain in commercial condition any or all trucks for $300 per car per year.

We believe that the above arrangement should satisfy any concern which is honestly investigating motor vehicle possibilities and not taking advantage of a manufacturer's desire to place his machines on the market.

BIDDLE-MURRAY MFG. CO.

Chicago, Ill.

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DEMONSTRATIONS ONLY IN UNUSUAL SERVICE

Unless there is something very unusual about the service required of the vehicle no probationary work is necessary other than enough to show that they are up to catalog specifications and in good working order. If a wagon is guaranteed to carry so many pounds of merchandise at so many miles per hour under ordinary conditions, the customer knows what is coming to him, irrespective of periods of demonstration, long or short. Of course as the performance of the power wagon, as well as the cost of its maintenance, varies somewhat according to the attention given instructions for its care and operation, long periods of demonstration would serve to bring out different results in individual cases. But in the present state of the art information thus gained would hardly be of sufficient use to the manufacturer to warrant him in going after it in this way. He knows and guarantees what his wagons will do under conditions which are sufficiently definite to furnish a criterion for general use.

ELECTRIC VEHICLE COMPANY.

Hartford, Conn.

MANUFACTURER'S GUARANTEE IS WORTH SOMETHING

It seems to be the general impression among mercantile concerns that the power wagon manufacturer should furnish, free of cost, a demonstration lasting for a period of from 30 to 90 days. But they fail to consider that by so doing the manufacturer delivers to the prospective or intending purchaser a new wagon which through use becomes second-hand, while not injuring the apparatus in any way.

Usually toward the termination of the trial period, after economy has been demonstrated, the prospective buyer comes to the conclusion that there is no limit to loads that can be carried, and desires a larger wagon, one of greater load carrying capacity built for his use. This puts additional expense upon the manufacturer, which seems to be unnecessary considering the present state of the art. Power wagons are now built that are reliable and economical, and of both small and large carrying capacity.

It seems to us that if manufacturers limited the demonstration period of all wagons to 15 days, in that time satisfactory evidence could be furnished to any intending purchaser which would convince him that the vehicle was capable of performing its duties. If we followed up the applications we are receiving for demonstrations, we would be compelled to call upon the United States mint for assistance.

It is really unreasonable for an intending purchaser to ask a long demonstration, particularly when the wagon is guaranteed by a reliable manufacturer. If the purchase was a team of horses no dealer would allow more than a day's use of the team. While we, like all manufacturers, are desirous of securing all the business in sight, we feel that prospective purchasers should take into consideration the fact that our guarantee is of some value.

KANSAS CITY MOTOR CAR CO.

Kansas City, Mo.

DEMONSTRATION UNNECESSARY IN MOST CASES

We find in most instances that a demonstration of one or two days is all that is necessary, and we deem it amply long for anyone. When the buyer is dealing with a reputable concern, and one which guarantees its cars and agrees to refund the money if they are not as represented, we can see no reason why a demonstration of any kind is necessary. While we believe our dealers give from one to two days to a week's demonstration, we have constantly refused to give demonstration to anyone, and when our dealer does so it is necessary for him to do it with his own machine.

Summing the matter up, we can say with perfect frankness that from one to two days' demonstration is all that should be required at the outside, and that in most cases a demonstration is not necessary.

LOGAN CONSTRUCTION CO.

Chillicothe, O.

HOW THE MANUFACTURERS ARE "WORKED"

The privileges of a demonstration are greatly abused by a great many business houses who perceive the convenience of trial cars placed in delivery service. The demonstration is not only a convenience, but an aid to their business which will net them at least 25% gain in transportation from the fact that the vehicles give customers prompt delivery, doing the work of three horses and wagons at one-third of the horse wagon cost.

A demonstration to a business house extends from one day to three weeks, but it is not satisfactory from the fact that the manufacturer is put to heavy expense to send his machine out in first class condition and supply a man who is perfectly competent to run it. We believe that a merchant considering the purchase of an automobile for commercial purposes should get data from other merchants who have had machines in continuous service for at least a year. Demonstrations are an imposition upon the manufacturer from the fact that he has to furnish fuel, oil, driver and the machine gratis, and also has to comply with the merchant's wishes in regard to time. We wish to relate an experience we have had with one of the largest retail houses in the city of Detroit.

These people have been considering the purchase of commercial cars for nearly three years, and we know they have had a demonstration from nearly every manufacturer in this country. These demonstrations would last all the way from 10 days to three or four weeks. This has not only been going on for one year, but for three years, and the poor manufacturer has had to furnish, as stated above, machine, gasoline, oil, and driver gratis. Up to the present time these people have not purchased a car.

We have a vast amount of business on hand at the present time, and are running our plant day and night, with double shifts, shipping on an average of five cars per day.

While the majority of our orders have been secured through agents owning a demonstrating car, we have had great success in selling through correspondence.

RAPID MOTOR VEHICLE CO.

Pontiac, Mich.

ONE DAY FOR ORDINARY WORK

The period of demonstration for a motor truck depends somewhat upon the nature of the service proposed. Ordinarily one line of delivery can be shown as well in one day as in one week or more; so also whether the truck can handle the required load, cover the required distance, and the amount of oil and gasoline needed for operation.

The life of the truck and the general cost of repairs cannot be told by a day's demonstration, or by a week's, but must be learned from those using trucks of similar make; and this, too, varies. We have trucks in use nine hours daily, and trucks in use nearly twenty-four hours.

Concerns use trucks for so many different purposes, such as drawing coal, hauling freight to points of shipment, delivery on routes, ploughing streets, etc., that one day would hardly suffice a careful purchaser, and possibly more time might be allowed; but one day for ordinary work and more time for special cases is an equitable rule.

KNOX MOTOR TRUCK CO.

Springfield, Mass.

PAST EXPERIENCE BETTER THAN DEMONSTRATION

We do not believe that demonstrations for any long period are necessary or serviceable, provided the manufacturer understands thoroughly the exact conditions under which the vehicles are to be operated and produces same with adequate power to meet such requirements, with a reasonable margin of safety. This is particularly true with electric wagons, which can be figured to a positive certainty on load capacity, mileage and speed for any period of years, provided the vehicles receive reasonably good care and attention.

Long demonstrations, as a rule, prove nothing conclusively. Often they tend to confuse the prospective buyer rather than confirm any belief he may have had concerning the advantages of

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power propelled vehicles. Hundreds of electric vehicles are being used in all kinds of service, and have proven to be a safe investment and a great saving over the old horse-wagon service. Past experience proves more than demonstration.

McCREA MOTOR TRUCK COMPANY.

Cleveland, O.

NOVELTY HUNTERS AND ADVERTISEMENT SEEKERS

It seems to us that the period for a reasonable demonstration of a motor truck depends very largely on whose truck it is. We drove a motor from Boston to Washington and back twice, stopping in every city of any size to make demonstrations, varying from a half day to three days, to such parties as were interested, the whole trip covering a period of about seven months. In that time we never made a price or solicited the sale of a vehicle, and we were making the demonstrations in our own interest as well as that of our customers.

After that period we commenced selling cars, and have confined ourselves, except in very exceptional cases, to two or three days demonstrations, sufficiently long to cover the particular routes in which the cars were to be used. Probably two or three of our sales were made with demonstrations of a day or less. We have invariably found that parties wanting a long demonstration are more interested because of the novelty or advertising they could get out of it than they were in the purchase of a wagon.

The objections to the lengthy demonstrations are, in our opinion, entirely time and expense.

KNOX AUTOMOBILE CO.

Springfield, Mass.

FAVORS A LENGTHY DEMONSTRATION

We think it is up to the manufacturer to be willing to place his cars in the hands of the users for demonstration purposes. That is to say, the manufacturer or his agents should agree to provide a man to teach the customer's employees how to drive the wagon, how to take care of it, the fine points regarding its mechanism, and the car should then be tried out for a period of at least a quarter of a year to demonstrate its success and economy.

If it does not show a cost per ton mile of less than the horse drawn vehicle, then it is not worthy of adoption; but if it does demonstrate, at the end of the quarter year, that a saving of even a fraction of a cent has been made per ton mile, then the car has certainly proven that it is worthy of adoption by the customer, as in a term of a year the fraction of a cent per ton mile will amount to hundreds of dollars, if the customer does any amount of business.

We think that there is no test in reason which the manufacturer should not be willing to try.

MAXWELL-BRISCOE MOTOR CO.

Tarrytown, N. Y.

DUPLICATION OF DEMONSTRATIONS UNNECESSARY

We presume that in this early stage of the industry it is absolutely necessary to demonstrate a motor truck or delivery wagon in actual service for an establishment which contemplates the purchase of vehicles of this sort. But this is one of the things that will disappear after such a demonstration has been made once or twice, because after such a demonstration has been made to the satisfaction of some purchaser in a city it should not be necessary to demonstrate to succeeding purchasers in the same place. The objection to this policy, of course, is the heavy cost to the manufacturer, which somebody has got to pay.

THE OSCAR LEAR AUTOMOBILE CO.

Columbus, O.

THE BONA FIDE DEMONSTRATION

Once the economical running qualities of any truck are established only short periods of demonstration should be requisite. We believe that if the manufacturer has a prospective sale conditioned upon a satisfactory demonstration, thirty days' trial at the outside should suffice. In other words, the truck must actually possess true economical features and some established record in other service. Given this, the manufacturer should be willing to make a thirty-day demonstration on such bona fide trial order.

SYNNESTVEDT MACHINE COMPANY.

Pittsburg, Pa.

DARRACQ AND SERPOLLET JOIN HANDS

ANNOUNCEMENT has just been made of the formation of the Darracq-Serpollet Omnibus Company, with a capital stock of $2,500,000, to construct steam motor buses and heavy motor trucks, under the Serpollet patents. This company represents a combination of Darracq and Serpollet interests. Serpollet has agreed to enter the service of the company for the period of 10 years.

MOTOR BUSES FOR LONG BRANCH

AT Long Branch, N. J., a company has been organized to operate motor buses on routes now covered by about fifty horse-drawn buses. Three motor vehicles will be in service by June 15th. The capital stock of the new company is $100,000.

INSTRUCTIONS FOR SOLDIERS

SOME really useful duties are being planned for the inactive British soldiers. It is proposed to instruct men in the last year of their service concerning the manipulation, care and repair of automobiles. This, coupled with the keen interest the War Office is taking in the work which motor vehicles might be expected to accomplish in the transportation of men and munitions, gives rise to the hope that before long the automobile will be employed in conspicuous usefulness in the army.

STREET RAILWAY TO USE BUSES

THE street railway authorities in Brussells, Belgium, have decided to operate a motor omnibus service. Three vehicles will be employed at the outset, each carrying 30 passengers.

MOTOR AMBULANCE FOR PRUSSIAN ARMY

AN electric ambulance has been ordered by the Prussian army authorities. The vehicle will be under the charge of the sanitary department. It is in all respects similar to the vehicle which was recently put in service by the Berlin First Aid Society. The ambulance is intended for long distance service, and is supplied with battery power sufficient to give a radius of 68 miles at a speed of 43½ miles an hour.

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Largest Purchase on Record

Adams Express Co., Convinced of the Economy of Power Wagons, Buys 150 of Them

UP to date no historian of current commercial progress has felt moved to record the purchase, early this year, of 150 power wagons by the Adams Express Company. This is hardly surprising since the contracts for their construction were awarded at a time last winter when the eastern automobile shows were exciting manufacturers and bewildering their customers.

Nor would the matter now command more than passing attention if it did not serve to accentuate the already well defined public impression that the commercial motor vehicle, whatever its type, is, by the largest establishments exclusively engaged in the transportation of city merchandise, so highly regarded as to justify an investment by one of them of something like $250,000.

But this is merely a beginning for firms of this class. Within a year the sum mentioned as expended for improvement of service will be dwarfed by the outlay which will be made necessary for pressing the advantage already gained.

It would be a grievous error to conclude that the partiality which the large express companies are showing toward the electric wagon is a sign of their indifference to the merits of the gasoline wagon. From the fact that they actively employ a very considerable number of gasoline vehicles, it must be evident that their present or eventual expectations are not wholly in one direction. The point of most importance, however, to be remembered in connection with express company use of power wagons is that they consider the time ripe for their employment in large numbers.

Four years ago the attention of city transportation specialists was drawn to the highly economic performance of an electric wagon employed in the service of a large Pittsburg express company. The agent, who supervised the operation of this vehicle, being gifted with fine administrative capacity, was determined that it should earn its stable room. He began, therefore, by instructing a subordinate to retire four single-horse wagons and have their work performed by the power wagon. The result of this businesslike procedure in applying a labor-saving device—which term accurately describes the power wagon—was that only one of the four horse-drawn wagons was put back in service, and it was only employed for emergency work. At the end of one year, the agent submitted to his superiors the table of comparative costs for operating both kinds of vehicles shown below.

Note that the battery is not regarded as investment, but as "slow fuel," which in effect it really is. It should also be borne in mind that the wagon was fitted with iron tires, although if it had been fitted with rubber tires the maintenance cost would not have been greatly increased, as the electric vehicle was of the same rated load capacity as the horse-drawn vehicles which it superseded.

HORSE WAGONS

INVESTMENT		ANNUAL EXPENSE		
3 Wagons at $175	$ 525	Interest at 6%		$ 69 90
4 Horses at $160	$ 640	WAGONS		
Total rolling stock	$1165	Depreciation at 10%	$ 52 50	
		Repairs at $35	105 00	
				$ 157 50
		HORSES		
		Depreciation at 20%	$ 128 00	
		Feed, shoeing, care, and stable expense at $28.75 per month, $345 per annum	$1380 00	
		Blankets, stable fixtures, harness at $3 per month, $36 per annum	$ 144 00	
				$1652 00
		MEN		
		3 at $45 per month		$1620 00
				$3499 40

ELECTRIC WAGON

INVESTMENT		ANNUAL EXPENSE		
Total rolling stock	$1925	Interest at 6%		$ 115 50
Deduct 1¼ batteries at $500	625	BATTERIES		
Wagon without battery	$1300	Electric current, care and renewals of 2 sets of positives and 1 set of negatives per annum		400 00
Deduct Motors	300	WAGON		
Wagon and remainder of equipment	$1000	Depreciation of motor 5%		15 00
		Depreciation of remainder of wagon at 10%		100 00
		Mechanical repairs at $9 per month		108 00
		MEN		
		1 at $60 per month	$720 00	
		1 at 45 per month	540 00	
				$1260 00
				$1998 50

Annual saving Electric Wagon over Horse Wagons..... ..$1500 90.

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Municipal Motor Wagons

Fresh Evidence of the Economy of Power Wagons Employed in Municipal Work

FURTHER evidence of the extent to which motor wagons are employed abroad in municipal service is herewith presented. None can have failed to notice the economy of these vehicles, the steadiness with which their service has been continued, and the early period—in some cases as far back as four years—in which their advantages over horse-drawn vehicles for similar purposes were recognized.

How much money might be saved to the taxpayers in cities like New York, Chicago, Philadelphia, Boston and populous centers by the total replacement of municipal horse-drawn vehicles by municipal power wagons, may not be more than conjectured without close investigation of existing conditions. But that the saving to be accomplished by the substitution would be very great, may be inferred from the fact that in cities of the first and second magnitude large areas must be covered by horse-drawn vehicles within a very brief space of time. The cleaning of streets, usually imperfectly accomplished at night, the watering of them, the collection of garbage, and work of like importance are functions of municipal work which can and should be expeditiously and economically performed by power wagons.

The health of a city is largely measured by its cleanliness. There are too many large cities in this country which are not kept clean, chiefly because the horse-drawn vehicles employed for the service cannot cover the territory to be swept and watered within reasonable time without the employment of many more vehicles than apparently the city authorities are willing to purchase. To economists of this order, the speed, load capacity, and money-earning powers of the motor wagon should appeal powerfully.

LARGE FLEET OF MUNICIPAL MOTOR WAGONS

The municipal authorities of Chelsea now operate six motor wagons, and recently placed an order for eleven more. The whole fleet of 17 will be actively employed in a few months, cleaning streets, watering them, collecting garbage and performing other important city work. The eleven new wagons will cost $27,750, which with the wagons already in service will put the total municipal investment at something like $43,800. Chelsea was one of the first cities in England, or anywhere else, to perceive the economic possibilities of the municipal power wagon.

GENERATING STATION POWER WAGON

The authorities of Blackheath's municipal light and power plant, located outside of London report as follows:

"We have been using a motor wagon in connection with our generating station for the past 18 months. It has proved reliable and satisfactory, and has undoubtedly shown considerable economy over horses."

LOW OPERATING COST OF FIVE-TON WAGON

From the city of Wadsworth, where a 25 hp. wagon is employed, comes this report of the municipal engineer:

"Cost of one motor wagon was $3,000, inclusive of watering and wagon bodies; employed for street watering and haulage; does not effect any economy when used for haulage on short distances; is not used for dust collection; is maintained by contract at $250 per annum; the average load is 5 1-2 tons; average weekly mileage is 144; and it is estimated that the annual cost, inclusive of depreciation, driver, repairs, insurance, stores, etc., is $1,392.72."

MORE ECONOMICAL THAN HORSE WAGONS

The experience of the municipal authorities of Maidstone is both interesting and instructive. It is thus recorded by the borough surveyor:

"The motor wagon which this corporation owns has been in use for a year and eight months. It cost $3,200. During the summer months it is used almost entirely for road watering, and for this work it has displaced three horses costing $2.40 per day per horse, cart and man, while the average daily cost of the motor wagon works out at $6.00. During the winter months the wagon has been used for haulage of granite and other road materials. It is found considerably more economical than horse haulage on journeys exceeding one mile; on shorter journeys, the difference between the two methods of cartage is very little. It has interchangeable bodies, and the water tank is arranged to fit inside the wagon, so that it has merely to be lifted out by chain and blocks, and the wagon is ready for any haulage purposes. The cost of repairs to the wagon, at the present, works out at the rate of about $300 per annum. Wooden wheels with iron tires are used. The average load is about 4 1-2 tons, the maximum load being five tons. We have not used a trailer with the wagon so far. The inclusive annual cost works out at $1,700."

MUNICIPAL COAL WAGON

The electrical engineer of the city of Huddersfield, which operates its own electrical light and power plant, states:

"The electrical department of the corporation has in use two steam motor wagons. These are used for carting slack from the local collieries, six miles away, to the electricity works. I present herewith a statement showing the cost of bringing slack from the pits:

Men's time driving and repairing motor wagon	$596.06
Materials for repairs and spare parts	117.36
Coke, 24 tons	60.48
Coal, 12 tons	37.44
Water	4.80
Waste	3.60
Oil, 63 gallons	12.60
Insurance	42.00
Driver's license	1.20
Annual working costs	$875.54

MUNICIPAL MOTOR BUSES

The municipality of Wolverhampton operates its own

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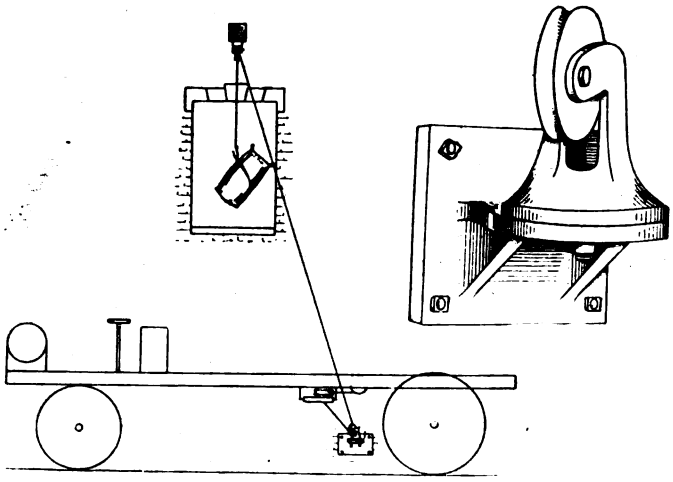
street railway and feeds it by motor buses. Describing the service its engineer says:

"The corporation has been working a motor omnibus service since September last year, and these vehicles have been well patronized during that time, upwards of 40,000 passengers being carried monthly. The district is not a populous one, the service worked being every 15 minutes, and every 10 minutes on Saturdays and special days. The buses are of the double-deck type, and seat 34 passengers each. The route along which these vehicles traverse has hitherto been of macadam, but a considerable distance is now being laid with tarmac, which will doubtless reduce the vibration and make the running more pleasant."

SELF LOADING DEVICES

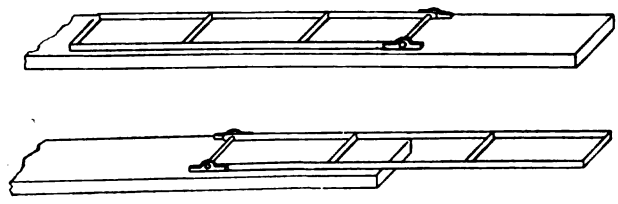
OCCASIONALLY the power plant in a motor wagon can be used with considerable advantage for other purposes than the mere operation of the vehicle. While the device shown in the accompanying illustration is not wholly novel in its character or application, it nevertheless will suggest a saving in manual labor to establishments which find it necessary to handle merchandise from the floors of lofty buildings oftener than is economical. Where the transfer of merchandise like, say, flour, is to be accomplished from floors of tall buildings to the motor truck below, the device illustrated will considerably expedite and cheapen the work.



A bracket supporting a pulley is fixed to the wall above the topmost opening in the side of the building. Fitted to this bracket is a casting that is free to turn in a horizontal plane. The bearings of the pulley are so placed as to bring the center of the pulley well away from the turning center of the casting. The effect of this arrangement is that any pull on the rope running over the pulley tends to rotate the casting until the pulley is in alignment with its rope. The rope winds on a drum operated by the power plant on the wagon.

PLATFORM EXTENSION DEVICE

OCCASIONALLY light but bulky loads have to be carried on big and little trucks whose platform areas are insufficient for the purpose. Cotton and woollen mills remedy this shortcoming by fitting an extension such as is shown in the accompanying illustrations, which lengthens the platform by three feet and thus affords an additional floor area of 90 square feet. Before this extension was employed the body extended two or three feet more than normal, but the stresses to which the longitudinal members were subjected when the load was roped compelled the abandonment of that form of construction. It is always an objection to the use of a supplementary platform that when light loads are not carried there is a temptation to



overload with heavy merchandize. The evils of overloading are not so few, or their toleration so inexpensive, that one can without reservation approve a device like that illustrated, although it is obvious that if the added platform area is not used for heavy loads its economy in light service justifies its employment.

MOTOR BUSES AS RAILWAY FEEDERS

MORE than ordinary interest attaches to the declared intention of the Berlin electric street railway company to supplement its service by the employment of motor buses, not merely on routes where it would be impossible to lay tracks and erect overhead construction, but wherever there is the slightest opportunity for making the vehicles available as auxiliaries.

The extensive character of the Berlin street railway system is hardly equalled in the world. But, although the car service is rapid and frequent, it ever falls short in caring for the fast swelling volume of passenger traffic. Evidently the street car company intends to compete with the Berlin General Omnibus Company upon conditions of the latter's own selection, the omnibus company having recently concluded to substitute motor buses for its horse-drawn vehicles. The first move of the railway company in this highly interesting struggle has taken the form of an order for 100 gasoline buses.

It is worth while remarking upon the difference of temper displayed by British and German street railway operators when threatened by the competition of the motor bus. In London the tramway companies have let loose a flood of inaccurate figures and abusive rhetoric in the hope of dissuading investors from buying stock in the various public flotations. By way of reprisal the motor bus companies have at every opportunity sought to defeat all measures for the extension of tramlines, particularly in the congested districts. In Berlin, the street railway operators, recognizing the usefulness of the motor omnibus, make it auxiliary, rather than inimical, to their service.

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Railroad Gasoline Cars

Seventh of These Self-Contained Units Now Being Operated by the Union Pacific Railroad

IT is a matter of no light consequence to the commercial world at large that the Union Pacific railroad continues to build gasoline motor cars—that, in fact, the seventh independent railway unit of this character has been put into commission after being tested to the satisfaction of its builders. The construction and continuous operation of these cars is equivalent to a broad endorsement of the gasoline engine in the most exacting service.

This welcome recognition of the utility and economy of the gasoline motor should, and doubtless will, put an end to all idle talk concerning the availability of such power for commercial service on streets and highways.

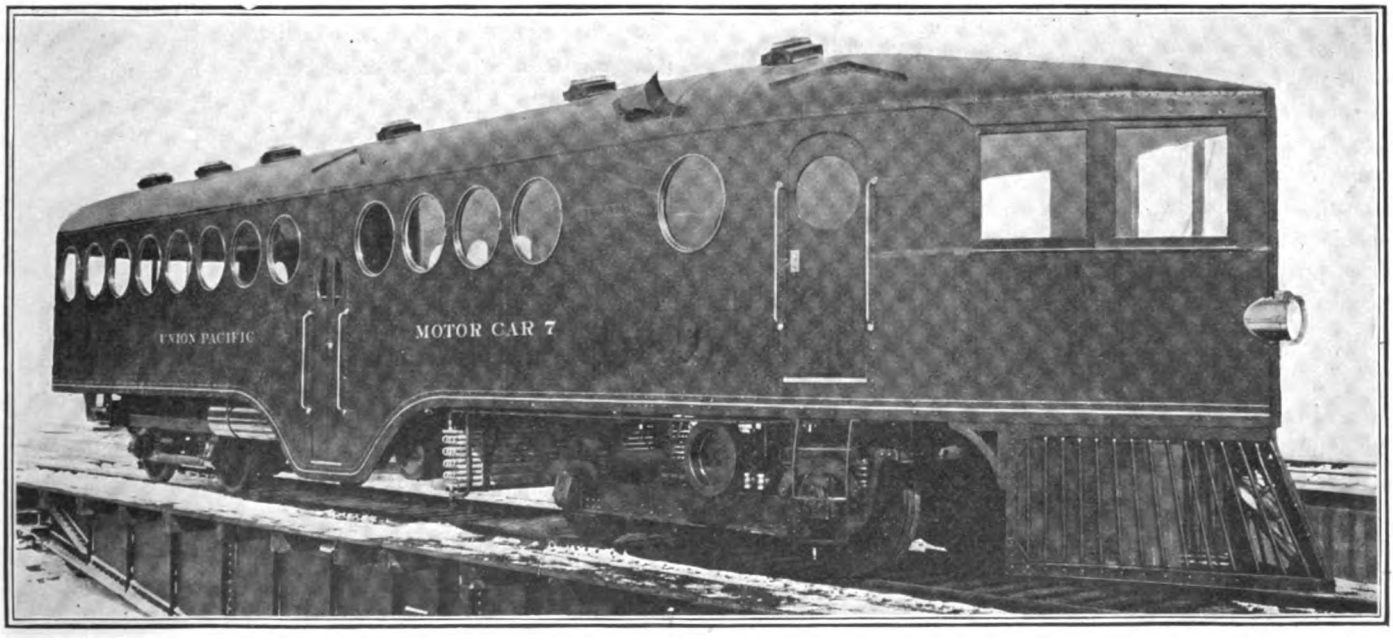
While enlightened people have not doubted the dependability of the gasoline engine, yet its adaptation to railroad service was required to prove to the unthinking masses that it is equal to the severest duty which may be imposed upon it. It would be impossible to conceive that railroads, operating with extreme precision, would adopt such a power for propulsion if it did not possess superior and well proven advantages.

The prosecution of the Union Pacific's ambitious designs lends encouragement to the commercial motor vehicle movement and is gratefully acknowledgged by all who have interest in its development. One may now look with confidence for a quick broadening of public opinion concerning the employment of vehicles of whatever kind operated by this power. Though their introduction has not lagged through lack of railway patronage, it is certain their use will be extended because of it.

During the past year seven gasoline rail motor cars have been constructed in the shops of the Union Pacific at Omaha. The last car to be built is especially designed for climbing grades and has several new features, the most conspicuous of which is the ventilation of the cars, the windows being round, similar to port-holes on steamships. The car is air, water and dustproof. It has side entrances in the middle of the car instead of at the end. The trial run developed a speed of 40 miles an hour with ease. The car is capable of 60 miles an hour. One man controls it. It is 55 feet long. Steel sills and bracing, and outside steel shell, give great strength to the car. It is light also, weighing only 56,000 pounds. The car has seating capacity for 75 passengers.

The roof is rounded so as to lessen atmospheric pressure when high speed is attained. The rear of the car is also rounded off, thus avoiding the vacuum which is produced by square end cars. The old-style sash ventilators have been done away with, and adequate ventilation is secured by roof ventilators, which exhaust by suction the air from inside the car, fresh air being taken in from the front of roof of car. A complete change of air can be obtained every four minutes, if desired. The floor has been made water-tight and can be cleansed by flushing with hot water, destroying all germs and disease. The water from the cylinder jackets of the engine is run around the sides of the car, so that in cold weather the heat is radiated to the interior of the car. In warm weather this water is piped to coils immediately below the car.

The car is driven with a 100-horsepower six-cylinder gasoline engine, built after special railroad patterns, designed to meet regular railroad car service requirements; has a "make-and-break" spark ignition, with a primary battery to start on and a magneto for regular running service. The cylinders are 8 x 10 inches, of the upright type, placed at right angles to center line of car. The six cylinders are arranged in opposed sets of three cylinders, resulting in three power-giving pulsations at each revolution of crank shaft. Air is used for starting the engine. The engine speed has a wide range of control, thus affording great economy under variation of load.



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Care of Storage Batteries

Practical Suggestions for the Proper Maintenance of Batteries in Electric Power Wagons

THE number of cells in a battery depends on the voltage the motor requires to operate it. It may have anywhere from ten to fifty cells, but the majority of vehicles for commercial purposes have from forty to forty-four cells. Each cell consists of a group of positive plates, which are of a dark brown color, and a group of negative plates, which are slate colored, there being one more negative plate in each group than there are positives. The capacity of the battery depends on the number of plates in each cell, and the voltage on the number of cells in the battery. When one negative group and one positive group are placed together there is a positive plate between each negative plate, and they are insulated from each other by wood or rubber separators, or both. The assembled groups are then placed in a hard rubber jar, which has two ridges on the bottom to hold the groups or elements up a short distance. Thus, if any material falls from the plates it will go below the plates instead of lodging between them and thereby causing a short circuit. The elements are then "burned" or melted together with a small hydrogen gas flame, which makes a perfect mechanical and electrical connection from one cell to the other right through the battery.

FILLING THE BATTERY WITH ELECTROLYTE

The battery is now ready to fill with electrolyte, which consists of pure sulphuric acid diluted with distilled water, the specific gravity being determined by the use of a hydrometer. No fixed rule can be given for the gravity of the electrolyte at this stage, as no two makes of batteries are the same. The mixture is approximately one part of sulphuric acid to three or four parts water. This is only given so that some slight idea can be had when getting the electrolyte ready. This will bring the mixture to between 1.200 and 1.250. It can be easily changed to whatever gravity the manufacturers prescribe by adding acid if the mixture is too low, or water if it is too high. Care must be taken to pour the acid into the water and not the water into the acid. Serious results may ensue if the latter is done, as the acid is liable to scatter. Mixing of the acid and water should be done in an earthen vessel or lead tank, as it will heat up considerably; if a glass jar is used it is very liable to break. When the mixture is thoroughly cold it may be poured into the cells to about one inch above the tops of the plates.

THE FORMING CHARGE

If there are only rubber separators between the plates the battery should be immediately put on charge at one-quarter the normal rate, the normal rate being usually 4-5 amperes per pound of cell. That is to say, if each cell of the battery weighs twenty pounds the normal charging rate of that battery would be 16 amperes. If wood separators are used the battery should be allowed to stand eight or ten hours before being put on charge, so that the separators will get thoroughly soaked. If this is not done high heat will develop, greatly detrimental to the life of the battery. While the battery is on forming charge it may heat up considerably. A thermometer should be immersed in the electrolyte. It must be watched closely, and before the temperature reaches 110 degrees F. the charging current shoud be lowered, as the temperature must not go above that point. In some cases it is necessary to stop the charging until the battery cools off, but this must not be done unless absolutely necessary. This forming charge continues until the gravity of the electrolyte reaches its highest possible point. The forming charge usually lasts seventy-two hours or more. When the forming charge is completed the battery should be placed on discharge at the four-hour discharge rate through lamps, or a suitable resistance, and should have an ammeter and voltmeter connected with it. Voltmeter reading should be taken every ten minutes throughout the discharge. When the voltage reaches 1.8 per cell the discharge should be discontinued and the battery immediately put on charge. If the battery does not come up to its rated capacity on the first discharge, it will be necessary to charge and discharge until it does. The battery being formed and giving the rated capacity, the covers should be put on the cells and sealed so the electrolyte will not slop over. This sealing is done by heating a composition of tar and soapstone in hot water, and working it in around the edges of the cells. It only remains now to load the battery in the machine and it is ready for service.

NEED OF CARE IN REGULAR CHARGING

The regular charging should be carefully conducted, as the life and efficiency of the battery to a great extent depends on this. As the voltage of the battery depends on the temperature, and it not being always convenient on commercial vehicles to get at the battery to ascertain the temperature, the following rule works very well: Charge the battery at the normal charging rate until the voltage reaches 2.5 volts per cell; then reduce the charging current to half the normal rate and keep charging at this rate until the voltage reaches its highest point, when the charge should be discontinued. Should the battery gas freely before the voltage reaches 2.5 volts per cell, it should be cut down to the half rate as soon as observed, as the temperature in all probability is high, and a high voltage need not be expected. In very warm weather it will probably be found that the normal charging rate is too high and will have to be reduced. The temperature of the battery must at no time exceed 110 deg. F. and for regular charging it is advisable not to exceed 100 deg. F. The importance of this cannot be made too emphatic.

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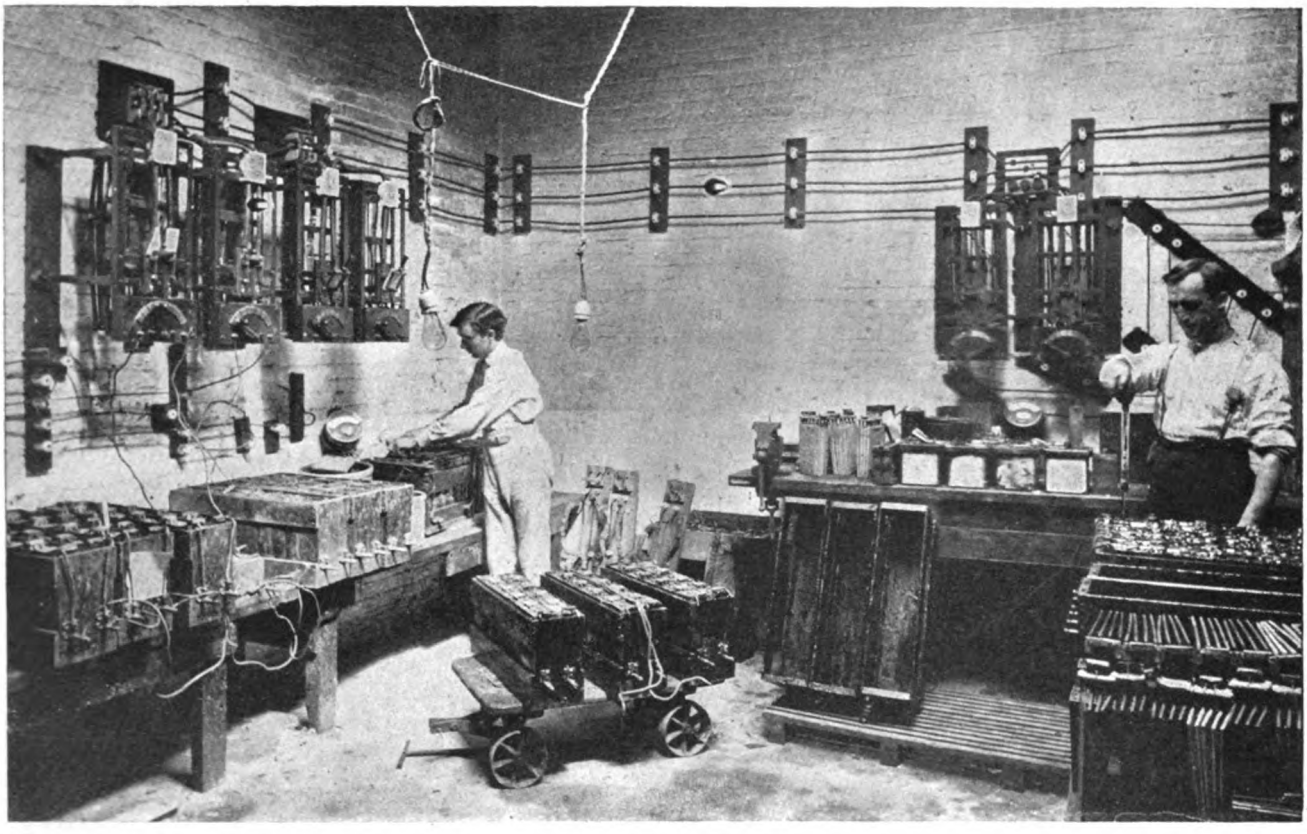
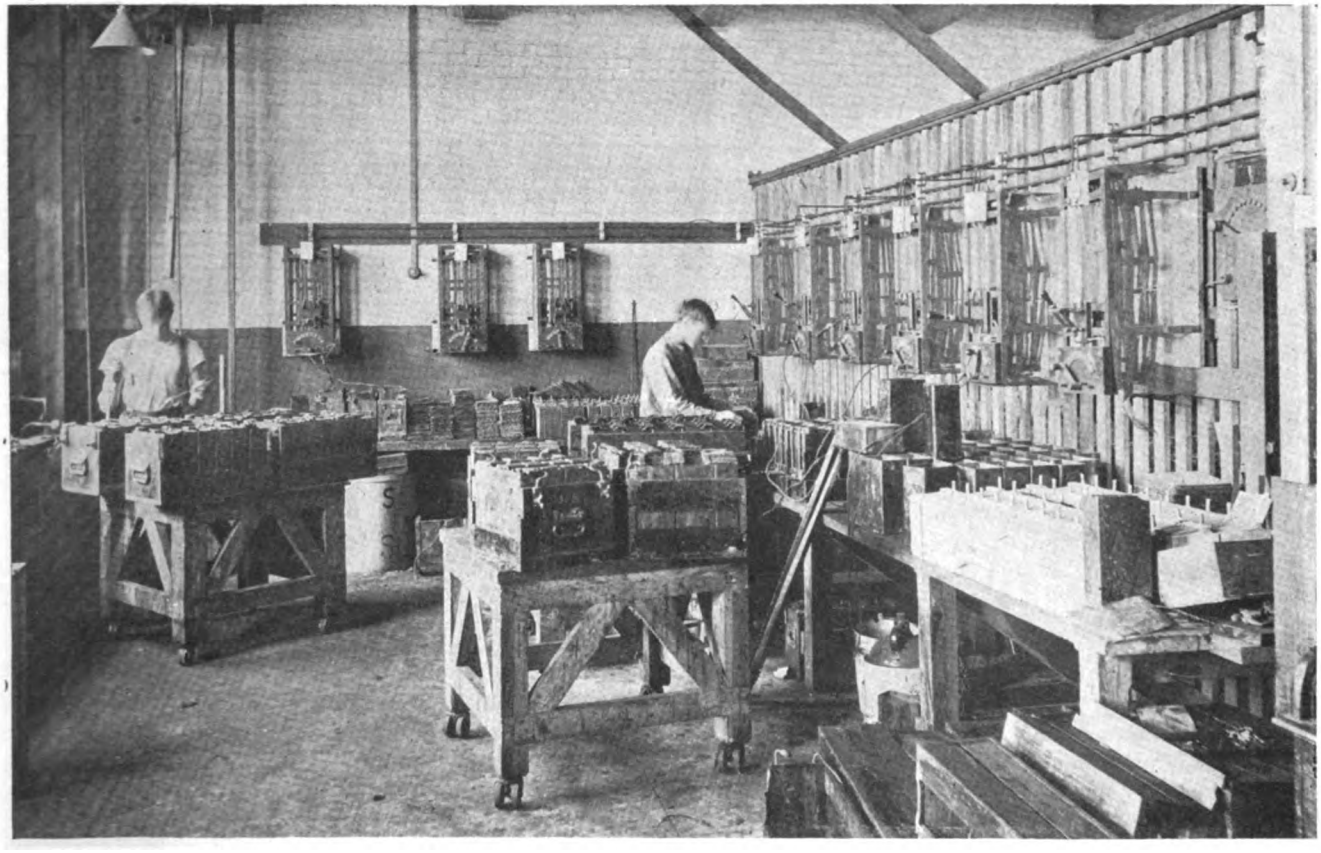
Features of an Electric Stable



CORNER OF BATTERY ROOM



ANOTHER BATTERY ROOM

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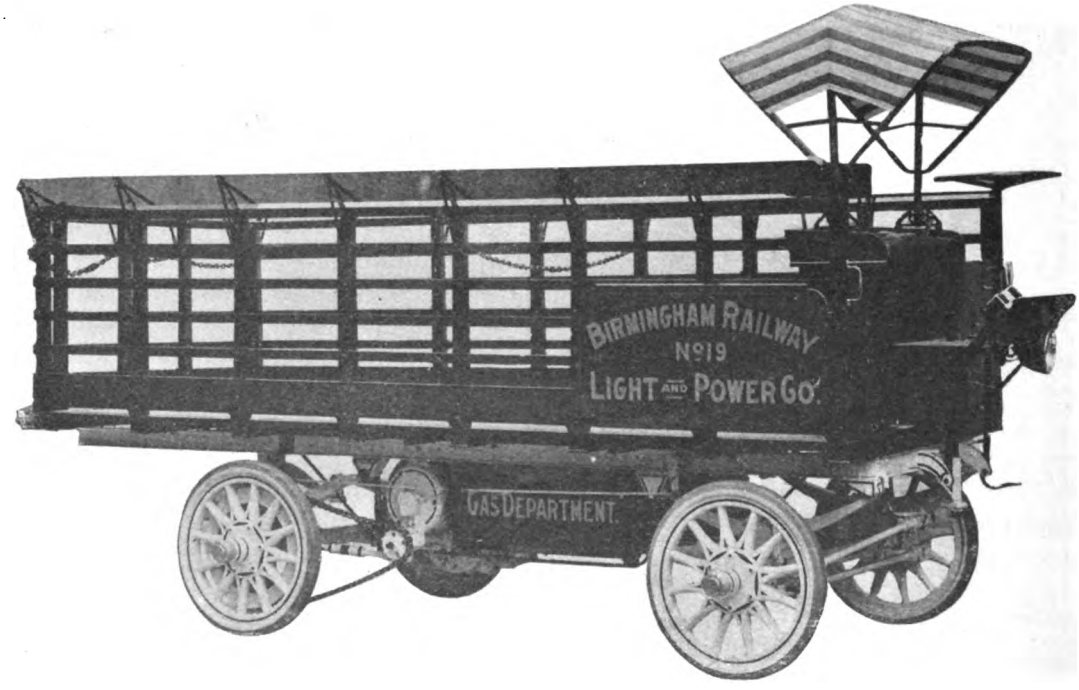
CHIEF CAUSE OF BATTERY DETERIORATION

What induces premature depreciation of a battery more than all other causes combined, is the too free use of acid in adjusting the gravity of the electrolyte. A battery in regular service is rarely absolutely free from sulphate, and the more sulphate which accumulates on the plates the lower the gravity of the acid will become. The acid adjuster tests the electrolyte in the battery, and if he finds it reads low he immediately fills the battery up with acid of high enough gravity to bring the electrolyte where he thinks it belongs. This being done several times a month, it can readily be seen that the electrolyte gets so strong that the plates are rapidly eaten away. When the battery is fully charged, it is perfectly proper to bring the gravity of the acid to the given point (generally 1.3). But here is where the trouble arises, as so few men taking care of batteries know when a battery is full. The majority of them depend on a voltmeter and ammeter, which for all practical purposes, when the temperature is taken into consideration, is best; but it is not sufficient when the electrolyte is to be adjusted. The best method is to give the battery a long, slow charge, until the gravity of the acid has reached its highest point. Of course, this method cannot be used in general practice, as it very often requires a day or two. Therefore it is recommended that nothing but distilled water ever be put in the battery. When the battery is washed the electrolyte should be correct, and ought to remain so until the battery is ready to be washed again. When the battery has been in use some time the gravity may be a little low, but this only impairs the capacity of the battery very slightly. It is far better to have the gravity too low than too high.

WASHING THE BATTERY

The sediment which accumulates at the bottom of the cells should be removed before it touches the bottom of the plates. To find out when the battery should be cleaned, a cell should be cut out at intervals and the depth of the sediment ascertained. The usual time for washing depends on the service the battery has given. Commercial vehicle batteries should be washed every three to six months. When a battery is to be washed it should be charged full and then cut apart and the plates washed carefully. The mud in the bottom of the cells should be washed out. If the active material on the negative plates looks granulated or spongy, they should be put between boards and pressed before they dry, and should then be washed. It can be seen at a glance whether the positives are fit to be put back in the battery or not. The negatives may appear to be in good condition, but when the battery is assembled and discharged it frequently happens that the negatives are found useless on account of the grids being sulphated, which insulates the active material from the grids. Before washing the battery it is good practice to cut out two to four cells, wash, charge and discharge them, taking readings with a low reading voltmeter, which will show just what condition the battery is in.



STREET RAILWAY COMPANY'S TRUCK

A number of electric trucks and light gasoline vehicles are actively and profitably employed by the Birmingham Railway, Light and Power Company of Birmingham, Ala. The company has acquired much experience in their operation during the past few years. The 2-ton Pope-Waverly truck shown above is the latest addition to its stable. It is fitted with removable rack sides, permitting the vehicle to be converted into a platform truck While the truck was made from a design drawn especially for the company, it will likely become a regular model with the Pope-Waverly people.

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Attention

OVERLOADING is the pet vice of power wagon drivers. If repair bills are high they seek the cause in defects of construction of the vehicle, never in their own maltreatment of the vehicle. Many of them are under the impression that because a motor wagon is rated at 20 hp. it has very ample reserve of power, and therefore can be overloaded and overworked with impunity, judging it by comparison with horse wagons. It must be understood, however, that while this 20 hp. represents a definite amount of work, the power exerted by a horse is a very varying quantity. It is well known that a horse will for a short space of time (pulling its load through a soft place) exert a tractive effort equal to as much as 14 mechanical horse-power. In addition, the energy of the horse is exerted in the direction of pulling its vehicle and load, while the power of the motor vehicle is applied at its wheels, and it has therefore to practically lift itself out of a soft place. Perhaps this explanation will enable motor wagon owners to realise the apparent disagreement between the two cases.

PROLIFIC CAUSE OF TIRE WEAR

Wheels out of line cause severe wear on tires. Misalignment of wheels may be the result of failure to properly adjust them, of a sprung axle or steering knuckle, or a frame distortion ascribable to careless driving with an exceedingly heavy load. But whatever the cause it is well recognized as the most principal source of tire wear and expense. A truck, therefore, should never be permitted to leave the stable without close scrutiny of its wheels. If the cause of uneven tire wear cannot be discovered changing the wheels may prolong their life. By lining up the wheels, front and back, it may be determined in a general way where the fault lies, and the remedy is usually self-suggestive. Of the troubles common to the steering parts, the bending of rods and arms are most frequently encountered, but, happily, the most easily remedied. Bent front axles are less common and far harder to locate and correct; bends in the knuckles are least frequent. In the driving wheels a difference in the tensioning of the radius or distance rods is very prevalent, thanks to hurried repairs. This, however, is easily corrected. A difference of this sort serves to set the rear axle at an angle to the chassis and swing both wheels out of line. Another cause of trouble in the rear wheels, which also is to be found occasionally in the front of the machine, arises from the offsetting of the springs, due to the side thrusts in rounding curves at speed. This difficulty results in shifting the axle bodily to one side, and causes one or both axles to set at an angle to the line of travel. Obviously this must result not merely in wearing the tires unevenly and unnaturally, but also must give rise to stresses unprovided for by the designer. With a shaft driven machine, the same thing may occur through the bending of a strut rod and the consequent disalignment of the rear axle, or its offsetting. Or, perhaps, a sudden lurch may cause an unusual strain upon the springs which, being too sudden to be absorbed by them in the usual way, results in misalignment.

WHAT ENGINE SKIPPING INDICATES

A skip in the engine is another trouble which may be caused by too rich a mixture, the surplus gasoline being deposited on the insulation of the spark plug in the form of soot, and as soot is a fair conductor of electricity, the current will leak out along the soot instead of jumping the gap formed by the spark points. The richness of the mixture will also be noticed by the exhaust gas having a strong smell. If very rich it can be seen in the form of black smoke, not blue smoke, as this latter symptom indicates excess of lubricating oil.

WATER IN GASOLINE

Water often gets into the gasoline. If the storage tank is buried in the ground see that the supply pipe is raised so high that a pool of water cannot form around it. Before washing a vehicle have the tank caps screwed tight. Aside from the motor troubles resulting from water in gasoline, there is risk from injury to cylinders. To determine if water exists in gasoline pour a little on a very dry and smooth surface and look for globules. Gasoline free from water will spread out evenly.

EFFECT OF HEAT ON LUBRICANTS

The first effect of heat on a lubricant is to considerably reduce its viscosity. The temperature of the cylinder wall in an air-cooled engine averages from 250deg. to 300deg. Fah., and in a water-cooled engine from 180deg. to 250deg. Fah. At the higher of these temperatures the lubricant is about as thin as water, and splashes just as readily. The following table shows, roughly, the change of viscosity with the rise of temperature:—

Temperature, (deg. Fah.)	75	110	150	250	300	350	400
Time of efflux in seconds	740	110	54	39	32	25	21

If there be an adequate supply, even in this last state, it is capable of preserving a good film between piston and cylinder, and it is not till temperatures of 400deg. up to 500deg. Fah. are reached that danger arises. At this stage a good deal of the oil is turned to vapor, and is no longer useful as a lubricant. Unless copious supplies are pumped in to make up the loss, the piston will seize, especially if it is a close fit in the cylinder, owing to the absence of the protective film which keeps the metal surfaces from touching. It is only partly true that, at a high temperature, the oil is evaporated, and, therefore, passes out of the exhaust with the burnt charge: the truth of it varies with the quality of the oil used. If you have a well-refined pure oil, 99 parts in a 100, say, are evaporated and do no damage; the one part is carbon-

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ised—that is to say, decomposed by the heat. It is solid matter in a very fine state of division; a portion of it will go out of the exhaust with the gases, the rest will be deposited on the walls of the combustion chamber, and on top of the piston. In the case of the oil containing notable quantities of impurities, the proportion carbonised is very much greater, and the deposit in the cylinder head grows more rapidly. There is another and a very prolific cause for this deposit, and that is, defective carburation. Either an over-rich or, an insufficiently-sprayed and vaporised mixture will cause a carbon deposit to form. In practically every case these deposits are the cause of preignition, and in many cases overheating.

DIRT AND SOME OF ITS DANGERS

To the inexperienced operator a small quantity of dirt scattered over the engine is of little importance. The life of an engine, however, almost wholly depends upon the care it gets. The recital of an experience bearing upon this matter will show the risks of neglect. A truck was run into the yard for some slight repair. It was covered with mud. As the foot boards over the engine were removed some of the mud fell upon the motor, which was still running, and a little of it was ground into the clutch sleeve. There being considerable sand in the mud it worked into the bearing, which shrieked rebellion. The motor was stopped and the sleeve washed externally with gasoline. Then the motor was started again, but the grinding did not cease. Finally the sleeve was taken out and it was discovered that a few grains of sand had become imbedded in the bronze bushing. A mat made to fit the foot-board thereafter protected the engine of that truck. It is a common failing of badly trained drivers to throw a little sand upon a slipping clutch. What does not imbed itself in the clutch leather will fly in all directions and find its way into the bearings. If a truck is not equipped with an underbonnet, one should be fitted. A piece of canvas under the engine is better than no protection at all.

VARIOUS GRADES OF GASOLINE

Commercial gasoline ranges between 65 deg. and 85 deg. Its grade is determined by the density. The usual grade for gasoline engines is 76 deg., although gasoline as low as 68 deg. may be used with a good vaporizer, if the weather is not very cold. Of course, the price varies with the grade. Buy a Baume hydrometer and test your gasoline. This is quite necessary in view of the fact that 4 deg. difference in the density will make a variation of 1½ to 2 hp. in the engine.

A "DEAD" LOAD

Lumber is regarded as a "dead" or unyielding load. It is classed among the forms of merchandise which cause the greatest shocks, strains and stresses to horse drawn vehicles, and is generally looked upon as correspondingly severe upon power wagons. The power wagon hauling lumber, however, has some very decided advantages over horse-wagons in similar service, wholly apart from its economy and superior speed. In starting, for example, if the power is skillfully exerted, the wagon is not racked. The Atlas 3-ton wagon shown above has replaced two horse drawn wagons and four horses. It makes five trips daily, carrying about 5200 pounds, covering about 22 miles in 5 hours, including stops for unloading, with gasoline consumption of 5 gallons. The wagon is in the service of the Kuntz-Johnson Lumber Co., of Dayton, Ohio.

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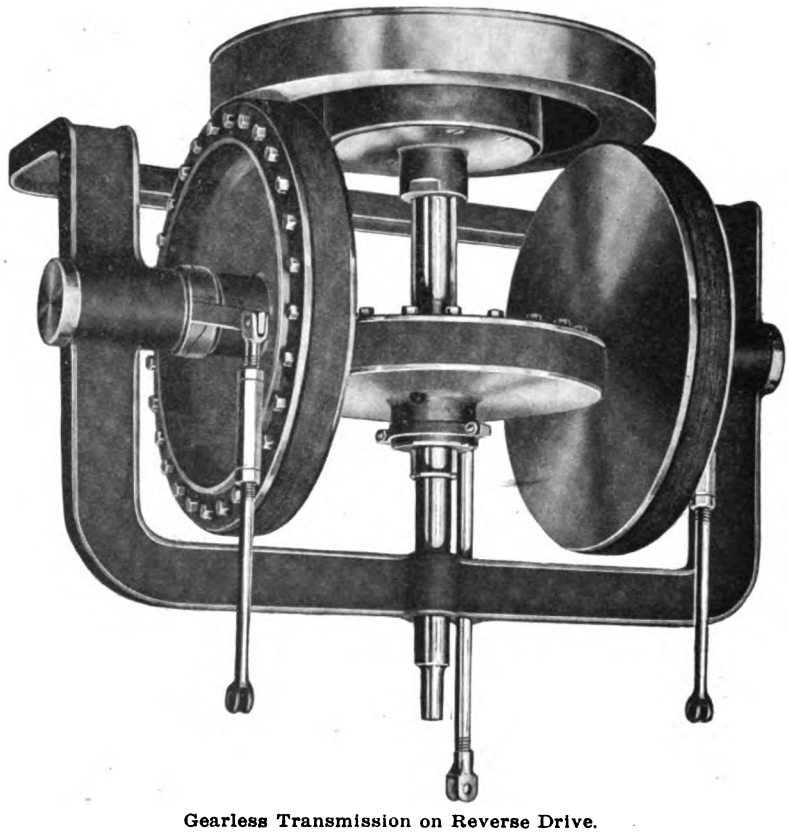
GEARLESS TRANSMISSION

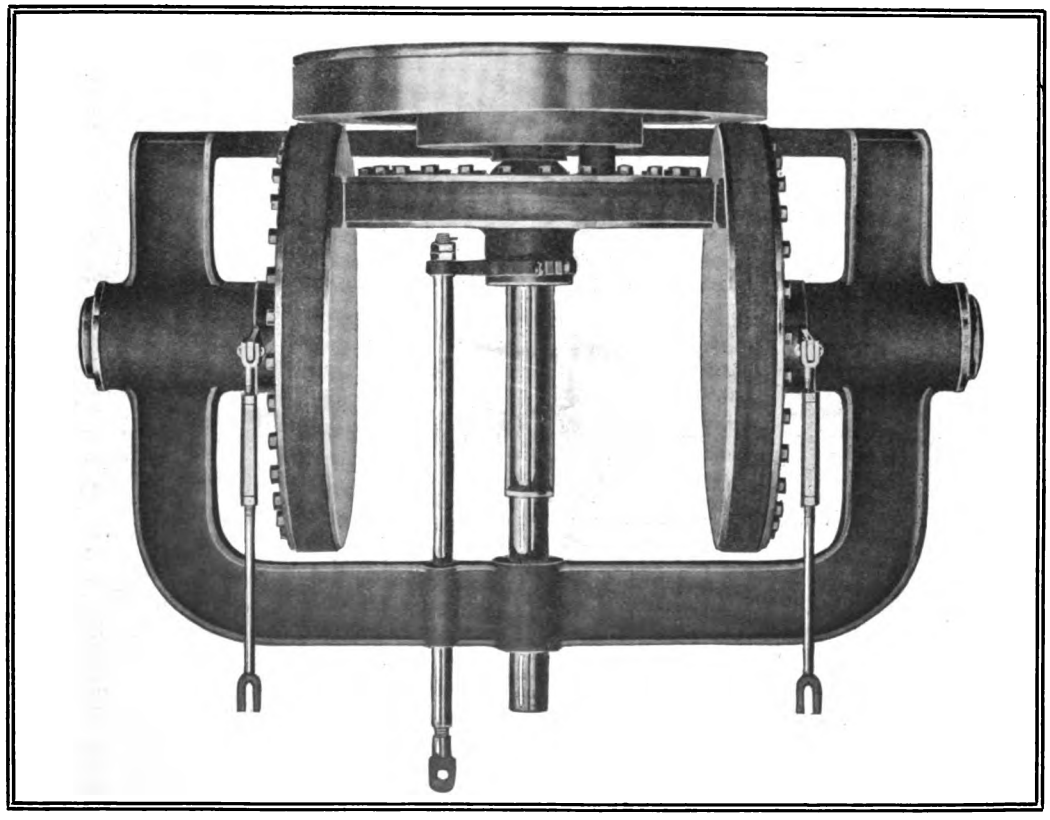
Conspicuous among the advantages claimed for the transmission made by the Gearless Transmission Company, of Rochester, are its power economy when driving direct, simplicity, noiselessness, availability as a brake, durability, accessibility, and immunity from injury. Trucks to which it is fitted start without jerking and consequently escape the attendant strain on running gear.

The frame of the transmission is attached to the truck frame at four points. On the high gear the two side wheels are out of engagement with the central driving wheel, which is splined to the main shaft. Thus the entire engine power becomes available for propulsion. Two sidewheels are brought into engagement with the engine fly wheel and central wheel by means of a foot lever, and the direct clutch is automatically withdrawn. Alignment of the driving shaft is not disturbed on account of the side wheels being put in contact with the central wheel, as the side wheels are operated in unison. The side wheels are driven in opposite directions. As their power is delivered to the central driving wheel from diametrically opposite points side thrusts on the driving shaft are eliminated. To back the truck the central wheel is shifted to the rear of the center of the side wheels, which reverses the action of the central wheel and its shaft. The friction surfaces of the central and side wheels have withstood the usage of 5,000 miles service without exhibiting any appreciable wear.



Gearless Transmission on Reverse Drive.

The drawings are not accurately descriptive of the mechanism, but nevertheless they serve to describe its principal functions. Two models are made, one for engines of 20 hp. and upward, and the other for engines with lower power. There is nothing experimental about this transmission. It has been in active operation for two years past.



Gearless Transmission on Direct Drive.

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WANTS TO BUY MOTOR PLOWS

MOTOR driven agricultural implements are attracting the attention of large land owners, who perceive the economies which are to be derived from their employment. Unfortunately, however, firms to whom the manufacture of these implements might reasonably be expected to appeal are either unaware of the active interest being taken in their use abroad, or else are blind to their advantages. However it may be, the fact remains that owners of large tracts of land in this country stand ready to buy them, in support of which statement witness the following letter:

To the Editor:—I notice in your edition of April 26, 1906, an article headed "Motor Talk to Farmers." When in England two years ago, I had an invitation to visit an exhibition of a motor plough, but was unable to do so. Friends of mine, who were there, spoke very highly of what they had seen.

I am in the market for from one to three of these motor ploughs, for a ranch that I own in southern California, and my object in writing you is to ask whether these agricultural motors for ploughing, harrowing, etc., are made in this country, and if so, where?

Will you please send me another copy of the magazine under date of April 26, 1906, and oblige,

J. H. FLAGLER,

New York City.

It is quite likely that the motor plow which Mr. Flagler was invited to witness in field service was made by the Ivel Company, of England.

ELECTRIC BUSES FOR NEW HAVEN

IT is likely that a company will be formed to operate an electric omnibus line in New Haven, Conn. It is the plan of the men identified with the enterprise to purchase four small electric buses at a cost of over $10,000. Henry W. Sanford, superintendent of the New Haven Ice Company, is one of the chief movers in the enterprise. He has interested others in the plan and the company will undoubtedly be organized.

OVER 400 MOTOR BUSES IN LONDON

UP to May 14 there were 422 motor buses plying the streets of London. The following table shows the distreets of London. The following table shows the distribution of the vehicles:

London Motor Omnibus Co.	107
London Road Car Co.	69
London General Omnibus Co.	67
London & District Motor Bus Co.	38
Thomas Tilling	24
Gt. Eastern London Motor Bus Co.	20
Star Omnibus Co.	18
Associated Omnibus Co.	17
London Power Omnibus Co.	14
Birch Bros.	11
New London Suburban Bus Co.	8
Victoria Omnibus Co.	7
Other owners	22
Total	422

ELECTRIC WAGONS FOR FIRE CHIEFS

TEN of the batalion chiefs in the fire department of New York City are to be supplied with Baker electric vehicles, possessing unusual speed and radius of action. The motor is mounted in the forward end of the wagon, while the battery is carried under the seat. The maximum speed of the vehicles is 32 miles an hour. The average mileage on one battery charge is between 40 and 50 miles, although in a test one of the vehicles covered 84¾ miles before the battery was exhausted. The weight of each vehicle is 1,800 lbs., with wheel base of 82 inches.

Information for Buyers

FIRE INSURANCE WAGON—The Woods Motor Vehicle Company, of Chicago, has received an order for the construction of an electric fire patrol wagon to be employed in the service of the Chicago Fire Insurance Patrol. The length of the body will be 13½ ft., while the wheel base will be 11 ft 6 inches. The front wheels will be 36 inches in diameter and the rear wheels 48 inches. The frame will be of pressed steel and the axles will be made of chrome-nickel steel. The wheels will be equipped with 3½-inch tires. The weight of the vehicle, without load, will be 8,000 pounds, and including load, 13,000 pounds. The car will accommodate twelve men. The normal speed of the vehicle will be 12 miles an hour and maximum speed, with full load, 20 miles an hour. The vehicle is to be delivered within 4 months.

AN INGENIOUS ENGINE.—The 10 hp. air-cooled engine of the delivery wagon made by the Logan Construction company, of Chillicothe, Ohio, recently illustrated in this paper, is of the two cylinder opposed type, but contrived with more than ordinary ingenuity. The outer walls of the cylinders are cooled by sheet copper flanges tapered and fitted tightly on the cylinders, ¼ inch apart. There are thirty-five of these flanges, giving 54 square feet of radiating surface. Attention is called to this use of sheet copper, which is well known as one of the most sensitive thermal conductors. The air is kept in circulation by an eighteen-inch fan. On the top of the crank case (which is left open when cast) is a hopper made of sheet copper. Within it a series of screens prevents oil from the crank case splashing out. Air circulates freely through this hopper into the crank case, cooling the piston-heads, inner walls of cylinders and bearings, and allowing all heat and gases to escape. The cooling of this engine is so perfect that it is able to use seventy-five pounds compression without danger of overheating. A customer who uses this engine says he has allowed it to run two hours at a time while standing, without overheating. He also states that he drove 135 miles in six and one-half hours without stopping the engine, during a sultry day last September.

MORE FACTORY ROOM. — Work on the addition to the Pope-Waverley factory, Indianapolis, has been completed. It gives much needed room. The entire plant is devoted exclusively to the manufacture of electrics, both for commercial and pleasure use. Most of the addition will be occupied by the body and truck departments.

"DIAMOND" CHAINS
Outnumber, Outwear and are Stronger than Others
WRITE FOR CATALOGUE
DIAMOND CHAIN & MFG. COMPANY
INDIANAPOLIS, IND.

Pressed Steel Truck Frames
The
PARISH & BINGHAM CO.
CLEVELAND, OHIO

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Valueless Demonstrations

Trials Merely Indicate Suitability of Wagons for Service in Which They Are Being Tested

EXPERIMENTAL demonstrations of the kind ordinarily witnessed so imperfectly indicate the sources or volume of the economy of power wagons that experts have come to regard them as flat, stale and wholly unprofitable performances. Occasionally the showy exercises which attend them may, and undoubtedly do, excite purchasers to a livelier realization of the shortcomings of draft animals than would be possible without the opportunity for indifferently comparing their inferior work with the superior work of motor vehicles. But to gain so small a point it should be unnecessary to continue the extravagant waste of time and money which even petty demonstrations seem to demand.

The sum of trade thought on the matter makes it clear that demonstrations indicate nothing but the mere suitability of power wagons for the service in which they are being tested. Recent testimony confirms this judgment, as will be evident from perusal of the following opinions:

* * *

WHOLLY OPPOSED TO DEMONSTRATIONS

We are opposed to making any demonstrations whatsoever. In localities where power wagons have been in use for a reasonable length of time, and where their advantages as well as their limitations have become known, such demonstrations should neither be necessary nor solicited.

Reputable builders of other kinds of standard machinery are not expected to offer demonstrations to their customers. Why, then, should this burden be placed upon the builders of power wagons?

Builders of power wagons have acquired, or will gradually acquire, if their business is to survive, a reputation for turning out only the highest grade of work and standing behind their product. Further, their selling organization will not attempt to place power wagons where their use is unlikely to prove eventually satisfactory. Their guarantee should constitute full proof to the customer that any power wagon they turn over to him will be adapted for his service.

Exceptions to the rule suggested above should refer exclusively to localities where power wagons have been previously entirely or comparatively unknown, and where their immediate introduction may seem expedient to the manufacturer, at some present sacrifice. In such cases, it would seem reasonable to make demonstrations extending over a period only long enough to allow the prospective purchaser to ascertain from observation that the power vehicle is capable of doing the work expected and promised by the salesman. Not infrequently it will be necessary to explain that the single wagon used for demonstration cannot be expected to do more than suggest by its operation how great a saving could be made by the use of a larger number of vehicles.

STUDEBAKER AUTOMOBILE CO.
South Bend, Ind.

* * *

DISCRIMINATION SHOULD BE USED

Demonstrations should be given with discrimination. No demonstration should ever be made until all the conditions are such as will exist when vehicle is put into regular service.

Merchants are besieged with propositions from local agents who are selling touring cars with wagon bodies, and are willing to recommend these for any kind of service, and naturally the merchant seeks safety in asking for a demonstration, nine out of every ten of which are bound to be failures. In fact, we have seen demonstrations which have been nothing but boomerangs, and have not only destroyed the confidence of the would-be buyer, but of the entire surrounding neighborhood of merchants.

We are strongly opposed to demonstrations, except in very rare cases. There are very few merchandise delivery propositions which are so intricate as to need any demonstration, for they are well within the ability of a

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good selling engineer to analyze and also well within the ability of the motor vehicle.

If a demonstration is demanded the salesman should demand a full and complete analysis of the existing conditions of delivery by horse-drawn vehicles, and when this has been obtained a demonstration should be planned which will properly show the relative merits of power wagons and horse-drawn wagons.

Merchants do not intend to be unreasonable, but they have such vague notions as to what a motor vehicle can do that, when demonstrations are made, their attention is often directed to performance which has no connection whatever with their trucking proposition, and only tends to divert their interest from the main issue.

JAMES MACNAUGHTAN CO.

Buffalo, N. Y.

* * *

ATTENDING CONDITIONS SHOULD GOVERN

The period of time required for a practical demonstration of a motor truck should be considered with the circumstances governing each individual purchase or sale.

If, for instance, the purchaser is not fully aware of the practicability of using a motor truck, and his requirements are large enough, it may be that the manufacturer can afford to give him considerable attention in the way of practical demonstration. If however, the purchaser is satisfied that the motor truck will be an advantage to him, and simply wants to know the power and capacity of different machines, a very short demonstration will prove the possibilities of any machine in question.

A motor truck, unlike a stationary machine, is liable tc great damage on account of the chance taken in operating it on a public thoroughfare, and therefore we feel that, like the sale of horses and automobiles, it should not be trusted in the hands of any one but a skillful operator in the employ of the manufacturer or dealer until after sale is closed.

DUNBAR MFG. CO.

Sandusky, O.

* * *

WELL DESIGNED TRUCKS NEED NO DEMONSTRATION

We can see no reason whatever for an extended period of demonstration. If the concern manufacturing a truck has a satisfactory business standing, and gives a proper guarantee against defective parts and incorrect design, making the guarantee cover sufficient length of time to insure purchaser against the development of defects which might not show in a short demonstration, we can see no reason for placing the truck in the hands of a purchaser, giving him the right to use it in his business for a lengthy period. We believe that if the truck is properly designed and constructed, and does its work for a few hours, it is sufficient guarantee of design, power, etc.

The operation of the truck in the hands of other parties who have purchased them, and are using them in their business, should also be a further guarantee as to its reliability, economy, etc. Unfortunately, the requests for long demonstrations, extending in a number of instances not only a few weeks, but several months, have been due to the endeavor of makers who have questionable designs of motor trucks, and no reputation as manufacturers, trying to effect a sale in that way, and with the design untried. If after such demonstration defects in design, etc., occur, the entire commercial truck business receives a black eye.

We have made demonstrations for companies who are handling large quantities of material, using a great many teams, for periods, in some instances, as long as three or four days; but ordinarily we do not demonstrate longer than one or two trips, or possibly one-half day's use. Under these conditions we have been able to find a market for more trucks than we can manufacture, and have for several months been running our factory, which has a capacity of output of three to five cars per week, depending upon size, both night and day, and are still far behind on orders. Our agents have been greatly annoyed from time to time with requests for long demonstrations and statements of probable purchasers that some other manufacturers are trying to give lengthy demonstrations, in many cases without even a provisional order, when if demonstration proves satisfactory the truck will be purchased.

We do not manufacture anything but motor trucks, and they are designed for strength, durability, economy of fuel consumption and lubricant and simplicity of operation. We believe the latter point to be one of the chief factors. Our designs were tested out for more than a year before being placed upon the market.

AMERICAN MOTOR TRUCK CO.

Lockport, N. Y.

* * *

TRUCKS IN SERVICE BETTER THAN DEMONSTRATION

I do not believe in lengthy demonstrations, and do not make them unless the parties have absolutely decided to buy the trucks. I believe the trucks in actual service, and figures and data as to cost of operation, after they have been used for a year or two, will mean much more to a prospective buyer than a demonstration for two or three days, or perhaps a week. Such information compared with the work of horse-drawn vehicles, is all that should be necessary. If we were to make demonstrations of two or three months, or even thirty days, for all of our prospective customers in Chicago, even if we were to charge for them, we would have a great many second-hand wagons on our hands and be under great operating expense. And I do not believe it would bring about any more satisfactory results.

GEO. A. CRANE & COMPANY.

Chicago.

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WAGON GUARANTEED; NO DEMONSTRATIONS

We do not give any demonstrations whatever, but sell our products as other products are sold. We give opportunity for thorough examination, require part cash in advance, balance on delivery, giving a full guarantee that the machine is as represented in speed, carrying ability, and wearing ability. Machine is returnable within thirty or sixty days if it is found not to be as represented, and money refunded, less a certan expense per day charged to the purchaser.

We can sell all our output in this way, and a great deal more. Promiscuous free demonstrations are pernicious in their educational influence and detrimental to the best interests of the trade. They are of no practical value to the purchaser. Any well built machine will, of course, wear well under reasonable use during any trial period granted by the manufacturer; so the purchaser might better first satisfy himself that the machine will carry the load claimed and travel the speed claimed, and take the manufacturer's guarantee as to its ability to hold up under service.

FOUR WHEEL DRIVE WAGON CO.

Milwaukee, Wis.

* * *

THIRTY DAYS DEMONSTRATION FOR QUANTITY BUYERS

In our opinion a thirty day demonstration should be given to a concern contemplating the purchase of a motor wagon, especially when the concern is in the market for more than three wagons.

BUCKEYE MANUFACTURING CO.

Anderson, Ind.

* * *

FAVORS CHARGING $5 A DAY FOR DEMONSTRATIONS

We believe that a week should be the maximum period for the average demonstration. Our experience has shown that from two to three days is usually sufficient. There are instances, however, where a week would not be sufficient length of time to make a proper demonstration. For example: A party contemplates the purchase of from 20 to 40 vehicles, and before making the purchase requires a demonstration of thirty days, during which time a careful record is kept of the tonnage, mileage, consumption of gasoline and lubricating oil, hours in service, and such other information as may be of assistance in determining the value of the service rendered by the motor truck as compared with horse drawn trucks. In a case of this kind we believe that an equitable basis on which a thirty day demonstration could be made would be for the person receiving the demonstration to pay a reasonable price per day (say $5) to the manufacturer, and also pay the necessary operating expenses, exclusive of repairs.

Looking at the subject from the standpoint of the prospective purchaser, he could not be expected to make the investment necessary to purchase one or more large trucks without being shown that he was getting his money's worth, and was going to make a saving over the cost of maintenance of horse-drawn trucks. To convince him, it would either be necessary to do his work for a short period in a satisfactory manner, or point to a sufficient number of wagons in similar service, and in some cases it might be necessary to do both.

RELIANCE MOTOR CAR CO.

Detroit, Mich.

* * *

ECONOMY OF POWER WAGON IS NOT DOUBTFUL

The power wagon has been thoroughly demonstrated, and its practicability is no longer a doubtful element. Therefore we think one to three days, depending upon the number of vehicles the party has use for, quite sufficient for a demonstration.

PACKARD MOTOR CAR CO.

Detroit, Mich.

* * *

ONE WEEK IS LONG ENOUGH

We consider that in one week's time a delivery car could be thoroughly tested. A prospective purchaser, in that length of time, ought to be able to detect any weak points in the vehicle.

MITCHELL MOTOR CAR CO.

Racine, Wis.

* * *

THIRTY DAYS FOR EXCEPTIONAL DEMONSTRATION

We should think that, under all ordinary circumstances, a practical demonstration covering a period of two weeks should be sufficient to accumulate such data as is necessary to enable a concern contemplating the purchase of a motor wagon to make their decision.

Under exceptional conditions the time required in demonstrating might extend to thirty days. However, we believe a fair maximum average time would not exceed three weeks.

PREMIER MOTOR MFG. CO.

Indianapolis, Ind.

RUNNING EXPENSES OF BUSES

FOR nine cents per car mile one of the large motor bus companies operating in London keeps its vehicles in thorough condition of repair. This is the contract maintenance charge made by the makers of the buses, and covers repairs of all kinds, tire renewals and lubricants.

An automobile mail route has been established for carrying mail between Oakley, Ida., and Burley, a new town in the western part of the state. Two vehicles have been purchased for operating the route.

The Southwestern Transit Company, which was recently organized at Guthrie, Okla., will operate automobile stage lines for the transportation of passengers, freight, mail and express. One line is operating out of San Antonio, Tex.

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Economy Now at Maximum

Under Prevailing Conditions Power Wagon Investments are Quickly Written Off

MERCHANTS who casually consider the employment of motor wagons often fail to perceive that at the end of a given period, lengthened or shortened according as service conditions fluctuate, the vehicles will not only have performed more work more expeditiously and satisfactorily than it could be accomplished by horse-drawn wagons, but will actually have earned enough to warrant the original investment being written off the books. Nor is this all, for if skilled intelligence has been exercised in caring for the wagons during the period of accounting their term of usefulness may be still further prolonged.

To measure the earning power of horses it would be necessary to contrast their work with the service afforded by some inferior beasts of burden, such as oxen. Practically, therefore, horses have no earning power in the sense that the term is used to denote superior performance by power wagons.

Some motor vehicles will earn their cost in two or three years. Others will require a longer time in which to work out the investment. But sooner or later—depending on the nature and activity of service, initial cost of vehicles, care in maintaining them, stable administration, and other factors of importance in power wagon accounting—the time arrives when even the most expensive and worst abused machines have paid for themselves. This state of affairs will persist so long as the inferior service of draft animals is largely employed for the transportation of city merchandise.

The economy of the power wagon is highest at this moment. For the gradual supersession of draft animals by motor vehicles must inevitably be accompanied by constantly increasing competition, not between mechanical power and brute energy, but between the various forms of mechanical power alone. Failure to recognize this highly important fact has, any time within the past four or five years, caused merchants who might have made liberal use of available power wagon design to waste large sums of money operating inferior horse-wagon services. Even today, when the fast increasing use of motor wagons heralds the near approach of the time when horse-wagon service will invite no fair comparison, these same merchants wait with youthful expectancy for the perfect mechanism which, without hitch or interruption, will perform delivery service with a teaspoonful of gasoline, a featherweight storage battery, or a steamless steam engine, sans lubricant, sans care, sans everything that will cause unaccustomed expense.

In a recent issue of *The Power Wagon* there appeared a table of operating costs, covering a period of one year, in which the inferiority of horse-drawn-wagons in express company service was strikingly shown. From the figures submitted it was very apparent that the purchase price of the motor vehicles employed in such work can quickly be recovered. The annual saving derived from the use of one power wagon was shown to be $1,500.90. As the wagon—now in its fourth year of service—was bought for $2,500 when new, its first cost was charged off at the end of one year and nine months. This remarkable economy, however, was considerably augmented by the use of iron instead of rubber tires, although the latter might have been employed with advantage to cushion the vehicle. Even deducting $150—the annual cost of a set of tires for such a wagon—this record of economy is a theme for constant wonderment to experienced as well as inexperienced investigators. To be sure exceptional ability was shown in the care, maintenance and routing of the vehicle, but, as such ability did not result from any previous experience with motor wagons, it is but fair to presume it was developed by regarding the power wagon as a time and labor saving machine which possesses nothing of importance in common with the service it superseded.

Obviously, then, since the personal equation plays such a conspicuous part in determining the economy of power wagons, it is a sheer waste of time for purchasers to endeavor to ascertain in advance of their employment how long a period of time must elapse before the vehicles will pay for themselves. But, remembering the ample margin of economy power wagons possess over the most highly organized horse wagon service, this denial need not be regarded as serious. Given a proved economy, it is for the purchaser to make it available, increasing it as opportunity offers, but never questioning its existence.

Automobiles carrying passengers and freight are to operate between Hollis and Eldorado in Oklahoma Territory.

Thawing the Main.

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Motor Cab Earnings

Estimate of Profits to be Derived From the Operation of 500 Gasoline Vehicles

WE have frequently remarked that the immensity of the economy which the extensive employment of commercial automobiles holds out is seldom, if ever, indicated by petty experiments with single vehicles. Striking proof of the soundness of this observation is afforded by a glance at the prospectus of a company just organized abroad for the operation of motor cabs in public service.

Five hundred gasoline cabs are to be operated by the General Motor Cab Company of London, which is capitalized at $1,300,000. The vehicles, which are to be built in Paris by Renault Freres, will cost, without tires, $1,440 apiece. The order for their construction was placed on May 5, the sum of $250,000 being paid in advance to guarantee delivery.

All vehicles will be fitted with taximeters, instruments which automatically record the legal fare. Four passengers can be carried inside the cab and one alongside the driver. It is at the option of the hirer whether the cab is open or closed, as it is of the landaulette type.

The Renault motor cabs are well known in Paris, where they ply the streets in considerable numbers. Probably 250 of them are so employed. Their earning power has been so satisfactorily demonstrated that the London company calculates each of its cabs will bring in $8.40 per day, less 25 per cent for driver's wages and fuel, the latter estimated as not exceeding 54 cents daily. Therefore the net earnings per cab per day, exclusive of administration charges, it is expected, will amount to $6.30.

The operating expenses given below are based upon the experience of the Paris Company, which certifies the accuracy of the figures:

Management, General Exp., Ins., Garage	$ .48
Cleaning	.20
Tires	1.08
Upkeep of motors	.48
Upkeep of cab bodies	.36
Lubricant	.10
	$2.70

The above expenses for tires, motors, bodies and lubricant are calculated on the basis of each cab covering a sufficient mileage to earn $8.40 per day.

Average gross profit per cab per day		$6.30
Average working expenses per cab per day		2.70
Profit		$3.60
500 motor cabs at $3.60 per day per cab profit, working 300 days		$540,000
Less taximeter royalty	$ 16,800	
" cab licenses	4,800	
" depreciation	120,000	141,600
Annual net profit		$398,400

While it is planned to write off the entire cost of the cabs within six years, at the rate of $240 per year per cab, it must be evident that this charge for depreciation is unusually liberal, as with reasonable care of motors and progressive repair of other wearing parts and equipment, there will undoubtedly be many cabs in excellent condition at the end of that time.

If the taximeter royalty charge was eliminated a still better showing could be made, but as the equipment of this device is a necessary feature of the contract with the builders, it must be accepted with equanimity by the investors.

All in all, the prospectus is typical of the profit which is to be derived from the extensive employment of motor vehicles in commercial service.

Motor bus service will be furnished this summer between Redrock, Midway, Cold Springs and Salmon, all Idaho towns, which are now being served by six-horse coaches. The duration of the motor bus trip will be eight hours.

Useful in Trimming Trees.

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U. S. Signal Corps Car

Value of Automobile in Army Work Prominently Shown by Service of This Vehicle

THE auto-telegraph car now being operated in the service of the United States Signal Corps post in Kansas has demonstrated its capabilities in the most exacting field trials. While the chassis of the car is identical with touring car construction, the body is of special design and of unusual size.

Under the seats are spacious lockers for the storage of signaling apparatus, such as rope, wire, and supplies of every description. At the sides of the car are racks for carrying lances or light poles which are employed in stringing a temporary overhead telephone or telegraph line when other supports for the wire are not available. From the ends of these racks iron rings depend through which straps are passed after having been drawn around the bundles of lances, so that the poles are held securely in place. The car, complete, cost the War Department $2,525. It has a variety of uses, but primarily its function is as a transportation utility in the construction, maintenance and operation of temporary or permanent telephone or telegraph lines.

Its great superiority over all other vehicles ever employed in the erection of communicative lines is found in the fact that it has the power requisite to enable the Signal Corps men to keep pace, in erecting a line, with the fastest moving cavalry or artillery force. Heretofore, the squad erecting a field telegraph or telephone line has frequently been left far behind during a forced march, the result being, of course, a serious complication, since the advancing soldiery was thus cut off from its base of supplies.

Of equal importance is the adaptability of the car for use, on short notice, as a portable field telegraph and telephone station. With only the brief delay to establish field wire connections, communication may be opened with the terminus of the line thus "tapped," or any intermediate point. In the rear of the front seats is a wooden shelf, which, while ordinarily hung snug against the back of the seats, may be instantly lifted into a horizontal position. Upon this are placed telegraph and telephone instruments, and the operators taking their places at the seats adjoining the table are ready for military dispatching—sounders being provided so that messages may be received and transmitted regardless of the roar of musketry or other distracting noises in the neighborhood.

The car is operated by a twenty horsepower engine, has seating capacity for eight men, the detachment being known as the "Auto-Telegraph Squad," which is detailed and drilled especially with reference to this service. The squad comprises the driver, the officer in command; two expert telegraph and telephone operators, and four privates who are qualified to render service as linemen, and who also constitute an armed guard should the telegraphers need protection while in the discharge of their duties at the keys.

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Attention

IT sometimes happens that the front wheel of a heavily loaded truck, in passing over the crown of a crossing, close to the curb, will drop into the gutter and cause a fracture of the steering cross connection. In spite of this misfortune the truck should soon be able to proceed on its journey under its own power. A two-foot length of iron pipe sometimes used as a roller in unloading merchandize, is slipped over the broken rod. At each end of the pipe the rod is wound with stout twine in order to prevent the pipe from moving. A piece of wire cable is then made fast to one steering knuckle, wound around the rod and pipe and securely attached to the opposite side. The cable makes steering to the right effective by pulling the left knuckle, and to the left by the ends of the rod butting together inside of the pipe.

MISUSE OF THE HIGH GEAR

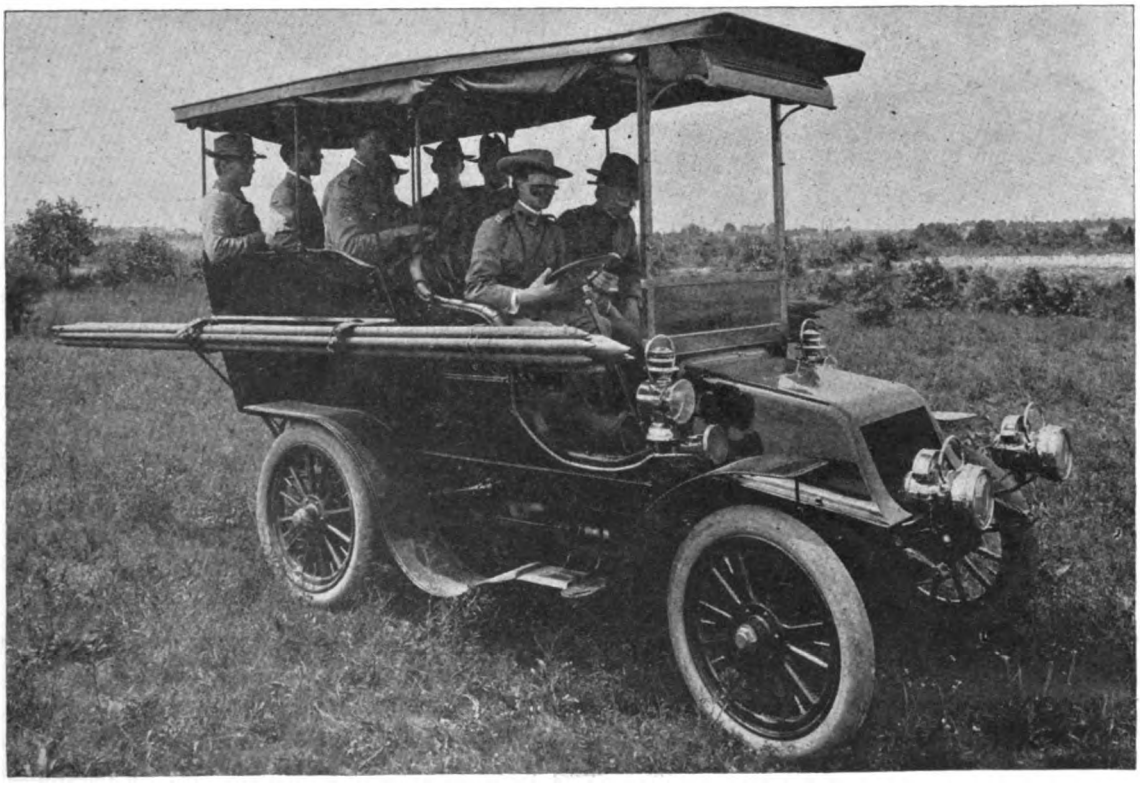
There is a great deal of misunderstanding over the proper use of the top speed of a wagon. It is all very well to keep the top speed in gear so long as the engine is not laboring, but directly it does so a lower gear should be put in. Further, the high gear actually does not drive the car so fast as would the next lower gear with the engine making a low number of revolutions a minute. No immediate injury may result, though crankshafts and connecting rods have been bent in this way before now, but it stands to reason that if this foolish practice is persisted in the life of the engine, gear, and tires will be shortened, and repairs, renewals, and adjustments will be required much earlier than they would had not the top gear been abused.

WHEN BRAKES DON'T ACT

If brakes don't act withdraw the clutch and change the transmission to the second speed. Then shut off the power and throw in the clutch slowly, and the truck will gently come to a standstill. It is not advisable to throw in the low speed, because this gives a sudden shock to the machinery and is apt to damage the merchandize. It is much better to use the second speed, throwing the clutch in very slowly. The effect is to shut off the shaft and engine, which are turning over by force of inertia. In this case the clutch acts as a brake.

STRAINING GASOLINE

It is important to strain gasoline. The outlet of the tank may be clogged with dirt, or the pipe leading from the tank to the carburetor may be choked, if it has many bends. A very small particle of dirt may have gotten into the tank by using a dirty filling can. Wooden filling cans or funnels should not be used, as small chips will be broken off from them and get into the tank. Pass the gasoline through fine wire gauze, allowing the gauze to hang over the edge of the funnel.



U. S. Signal Corps Car.

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Motor Bus Finance

Earning Power of Motor Buses Attracts the Attention of Company Mongers

SO long as it can be demonstrated that the net earnings of large motor buses are 4 cents per vehicle mile, after making suitable allowance for depreciation and administrative and operative expense, it is idle to expect that Londoners will refrain from subscribing to the capital stock of every public automobile enterprise which is put in front of them by plausible promoters. That this profit can actually be shown in well conducted services is beyond debate. Every investor, therefore, is inclined to believe that the particular enterprise in which he is interested can, if its management will but profit by the experience of others, make even a better showing.

Such optimism encourages the professional promoter to unwonted energy, his latest effort being the flotation of the Great Eastern Motor Omnibus Company, for which the huge sum of $2,025,000 is required for the acquisition of motor bus routes now under control of a company which has but twenty vehicles in service, and some other scattering assets of much more doubtful value. The business to be acquired by the new company is of a profitable character, showing gross earnings of $28.32 per vehicle mile and indicating the great scope there is for a motor omnibus service in populous districts.

One of the "assets" of the new company is a contract for the purchase of 25 motor bus chassis, the balance of 50 ordered on very favorable conditions. Another is the option on 150 more chassis. Still another is a contract for the purchase of gasoline, during a period of two years, at 12 cents per gallon. And, lastly, there is the "asset" of a tire maintenance contract, covering 50 buses, with the option of hiring 200 sets more on a mileage basis for a period of two years. This is *haut finance* of a particularly brazen order.

In the current issues of the British automobile press it is mildly pointed out that the professional financiers who are so keenly intent upon exploiting the motor bus industry, are taking unfair advantage of the public in capitalizing contracts which only possess value because of the prevailing stress in manufacturing circles, and the consequent inability to procure vehicles as fast as they are needed. It is certainly not a little remarkable that investors should be required to pay large sums for the right of buying (and eventually paying for) chassis to be delivered under a contract. It is equally strange that maintenance contracts should be regarded as assets, particularly when it is reflected that the concerns backing the guarantees are in many cases without substantial commercial standing.

The average mileage of a London motor bus capable of earning 4 cents per vehicle mile is in the neighborhood of 109 miles. This, therefore, is usually taken as the basis of all calculation. The new company expects to operate 200 motor buses which, running 100 miles per day, should yield a net profit of $291,998. Dividends, and the sum it is expected to pass to reserve, it is expected will absorb $187,800, leaving a surplus of $104,198.

So many motor bus enterprises have been projected and set going in London within the past six months that a consolidation of interests seems imminent. There is no very friendly feeling between the competing omnibus companies; in fact, they have only one thought or purpose in common, and that is to defeat any attempt on the part of the street railways to extend their lines.

The one remarkable feature of the whole motor bus business at this moment, aside from its rapid extension, is the steadiness with which the vehicles are kept in service. No other feature so unfailingly commands public attention, and it is preserved despite notoriously inadequate conditions of maintenance and management.

DESIRABLE SERVICE FOR ELECTRIC WAGONS

ELECTRIC railway lighting companies in large cities are deeply interested in power wagons. They maintain many horse-drawn line wagons for repairing overhead wires, as well as "connecting up" wagons for installing lamps and transformers and putting in the wires.

The "Connecting-up" Wagon.

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Economy of time in getting to the scene of trouble is of paramount importance in cases of fire or broken wires on crowded streets, for delays in making repairs means the tying up of the system, and frequently serious accidents to people struck by live wires.

The Toledo Railways & Light Company which operates both the street railway and lighting systems, maintains about fifteen horse-drawn ladder wagons and trucks for hauling material and connecting up work. It proposes to replace all its horse-drawn vehicles with electric wagons. There are many arguments in favor of the substitution and few against it. The horse-drawn vehicles are restricted in speed and capacity, requiring a number of extra horses to keep up the service, as the work is hard. It is necessary to maintain stables with numerous attendants in several parts of the city, and the expense of feeding and shoeing is heavy. The company could use current for its electric wagons at low cost. It has fully equipped repair shops, with men skilled in the maintenance of motors and batteries. In short, the maintenance account for electric vehicles would likely be reduced to a minimum.

At present the company employs two one-ton electric trucks in connecting up and handling material for the electric light department. Large reels of wire, tools of all kinds, meters, lamps and other supplies are carried, together with a crew of several linemen. Special drivers operate the trucks and care for them at the garage. Each truck has a radius of 40 miles, with one charge, and a speed of fifteen miles an hour. It covers at least twice as much ground in a day as a horse-drawn truck, and its speed in emergency runs is a strong point in its favor. The city of Toledo is well paved, and has no hills—ideal conditions for such service. The company is so well pleased with the results that it has ordered four more trucks, three to be somewhat heavier and equipped with ladders and tower for repairing trolley wires.

DIVERSIFIED USE OF MOTOR TRUCKS

SCATTERED throughout the pages of this issue will be found numerous illustrations which indicate the variety of uses to which the New York Edison Company puts its electric trucks.

In winter, when water mains are apt to freeze, one of the vehicles bearing an electric thawing apparatus will bring the most obstinate pipe to terms in a few minutes. The old method of tearing up the street and building fires around the pipe, or applying torches or live steam, took time and was expensive. The new method of applying the electric heat directly to the required spot is not only quick and safe, but can be used to as great advantage in private houses and other buildings as in the streets.

Another truck is used to transport crews of men with their materials for cleaning arc lamps in public places, like streets, bridges and parks. A third transports instruments and materials used in installations. Still another hauls loads of incandescent lamps for renewals in different parts of the city. A fifth is used for tree trimming where branches interfere with important wiring.

Motor trucks are used exclusively by this company and are continually demonstrating their superiority over the horse-drawn vehicle in matters of speed, economy, convenience, and the size and weight of the loads carried.

THE UNRELIABILITY OF HORSES

HORSE breeders and dealers are naturally hostile to the power wagon. They pelt it with abuse and magnify its shortcomings.

Not long ago a paper which ardently champions the horse and as hotly condemns the power wagon committed the folly of featuring a story which revealed the fact that out of 112 horses employed by a large trucking company, 67 were afflicted with a disease affecting the hoof, and which caused such inflammation, pain and lameness as to prevent the animals from working. With a great show of veterinary knowledge the chronicler of this unhappy incident concluded by relating that skillful treatment saved the lives of the animals, while in other stables in the same city it became necessary to kill several horses which were rendered useless by the disease.

Imagine the feelings of a merchant upon being notified by the head stableman that 60 per cent of his motor wagons were, for any cause, unable to perform their regular duties! People have grown so accustomed to the infirmities of the horse that when they are in good health they attract no notice, while when diseased they are thankful if they do not die.

IN HILLY DISTRICTS

IT is often urged as an objection to the employment of electric trucks that their limitations are easily found in cities where hills abound. As a matter of fact, in cities where grades are frequent and numerous, the loss of battery efficiency at the overloads required in ascent is largely compensated by currentless descent. It has been shown time and again in cities like Pittsburg that the battery mileage of an electric truck is not materially curtailed if the motors are accurately designed and their characteristics not unduly sacrificed in an effort to reduce weight. The mileage of electric vehicles seems to suffer most where the gradients are so easy that current is usually required in descending as well as ascending, or where surface conditions are so satisfactory as to keep drivers indifferent to energy waste.

With a service of automobiles over a superb gravel road a hundred miles north from Rawlings, Wyo., the Union Pacific expects to handle a large portion of the travel to the opening of the Shoshone reservation. The Northwestern has built an extension 150 miles west from Casper to reach the reservation, and the Burlington is rushing work on a line south from Billings, Mont. The Union Pacific, however, expects to land passengers on the reservation in less time than the Illinois railroads. Automobiles will leave Rawlings in the morning and reach the reservation the same afternoon.

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Care of Storage Batteries

Practical Suggestions for the Proper Maintenance of Batteries in Electric Power Wagons

THE charging current must in all cases be "direct," never "alternating." The positive terminal of the battery must be connected to the positive terminal of the supply circuit, so that the battery will be charged in the right direction. Charging in the reverse or wrong direction will seriously injure, if not ruin, a battery. In all cases when charging from trolley or other grounded circuits, the battery must be connected on the "ground" side, to avoid shocks when examining the battery and danger of breaking down the insulation.

SOME "DONT'S" FOR BATTERY CARETAKERS

The following "don'ts" should be posted conspicuously in all battery rooms:

1. Don't allow the temperature of a battery to rise above 100 deg. F. for regular charging.
2. Don't let a battery stand discharged.
3. Don't charge a battery oftener than is necessary to permit it to do its work.
4. Don't charge higher than the regular charging rate; but, if this has to be done, let the high charging rate be used at the first of the charge and reduce the rate as the battery fills up.
5. Don't fill the battery with acid to make up for evaporations; use distilled water only.
6. Don't allow the electrolyte to get so low that the tops of the plates are exposed.
7. Don't delay washing the battery until the mud touches the plates.

LACK OF CAPACITY

Should there be a decrease in the speed or mileage of a vehicle, the falling off may be due to trouble in the running gear, in the motors, in the connections or in the battery. If the current consumption, as shown by the meter, is greater than normal, the vehicle is running "hard," and it should be overhauled. If, however, the current consumption is normal, there may be poor connections or trouble in the battery. Falling off in the capacity of the battery can always be traced to some cause, and when it gives indications that something is wrong, take it out of the vehicle and look for trouble . There may be a dry cell, due to a leaking jar; some or all of the cells in a state of incomplete charge due to the battery having been run too low and not properly charged; the sediment or deposit in the bottom of the jar may be up to the plates, short-circuiting them (this trouble is always indicated by short capacity and excessive heating). If the trouble cannot be located by the eye, connect the battery in series and discharge it at the normal rate through suitable resistance. If a rheostat is not available a water resistance may be used. This consists of a receptable (which must not be of metal) filled with very weak acid solution or salt water, in which are suspended two metal plates, which are connected by wires through an ammeter. The current may be regulated by altering the distance between the plates. As the discharge progresses, the voltage should be frequently read at the battery terminals, and as soon as it shows a noticeable drop the voltage of each cell should be read with a low-reading voltmeter. While the readings are being taken the discharge rate should be kept constant and the discharge continued until the majority of the cells read 1.70 volts; those reading less should be noted. The discharge should be followed by a charge until the cells which read 1.70 volts are up; then the low cells should be cut out and examined.

CHARGING BATTERIES OUT OF WAGONS

When a battery is being overhauled or out for cleaning, it may be more convenient or suitable to charge it while out of the vehicle. In such a case the trays must be connected together in series and to the charging source in relatively the same manner as if they were in the vehicle; that is, the positive terminal of one tray must be connected to the negative terminal of the next tray, and the two remaining terminals, one positive and the other negative, must be connected respectively to the positive and negative terminals from the switchboard, but not until all of the trays have been connected together. If there is no ammeter on the board, connect one in series in one leg of the charging circuit. Great care must always be taken to have the polarities correct and the wire or cable for the connections of ample size to carry, without heating, the heaviest current used in charging. The size used in the vehicle will be proper. The operation of charging is then carried on in precisely the same manner as if the battery was in the vehicle.

TURN OFF LAMPS WHILE CHARGING

The lamps on the vehicle must be turned off while charging, as they are liable to be burned out by the increased voltage of the battery if they are lighted at this time. The bell must not be rung while the charge is in progress.

CHARGING THROUGH THE NIGHT

If, after a late evening run, the vehicle will be wanted early the next morning, the battery may be charged during the night without an attendant being present; but in doing this great care must be taken not to excessively overcharge. A careful estimate of the amount of current required should be made and the rate of charge based on this estimate. If, say, 72 ampere hours is required to recharge, and the time available is nine hours, the average rate of charge must be 8 amperes. If charging from a 110-volt circuit, the rate at the start should be about 10 amperes; if from a 500-volt circuit, about 9 amperes;

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as, in charging from a source with constant voltage, such as a lighting or trolley curcuit, the rate into the battery will fall as the charge progresses.

EXCESSIVE AND INJURIOUS OVERCHARGING

This abuse may occur in two ways, by charging too long and by charging too frequently, or every time a vehicle has been run a short distance. For instance, if a battery will run a vehicle 40 miles and the vehicle is run 5 miles, then charged, taken out again, run 10 miles and is charged, then is given another run of 10 miles and is charged and again a third run of 10 miles is made, followed by a charge. The vehicle has been run only 35 miles, but the battery has been charged four times. The greatest wear on the plates of a battery occurs during the final part of a charge. In treating the battery as above, it was charged three times oftener than necessary, and even then did not make the mileage it was capable of on one full charge. In other words, when a vehicle is in daily use for short runs, do not charge until over 50 per cent of the capacity has been exhausted. By following this course, not only is money saved on the current bill and the life of the plates increased, but the battery will give a greater mileage.

MOTOR AMBULANCES FOR CLEVELAND

MAYOR Johnson believes that the city of Cleveland should operate motor ambulances, and that they should be in charge of the police department. About 30 horse-drawn ambulances are now employed in the 13 police precincts, but they are not owned by the city, undertakers placing them at the disposal of the police. This practice results in waste of public money. The mayor will press the council to purchase and compel official operation of motor ambulances.

INTERURBAN BUSES AND TRUCKS

THE Wisconsin Auto Transit Co. is operating motor buses between Manitowoc and Kewaunee, stopping at all intermediate points enroute, and from Manitowoc to Kiel, also stopping at intermediate points. Double trips are made to each place every day. The regular passenger rate is 4 cents per mile, but to those who steadily patronize the service mileage books, good for 333 miles, are sold for $10. A little later the company expects to operate motor freight trucks. Road conditions are unusually good—gravel surfaces and light grades.

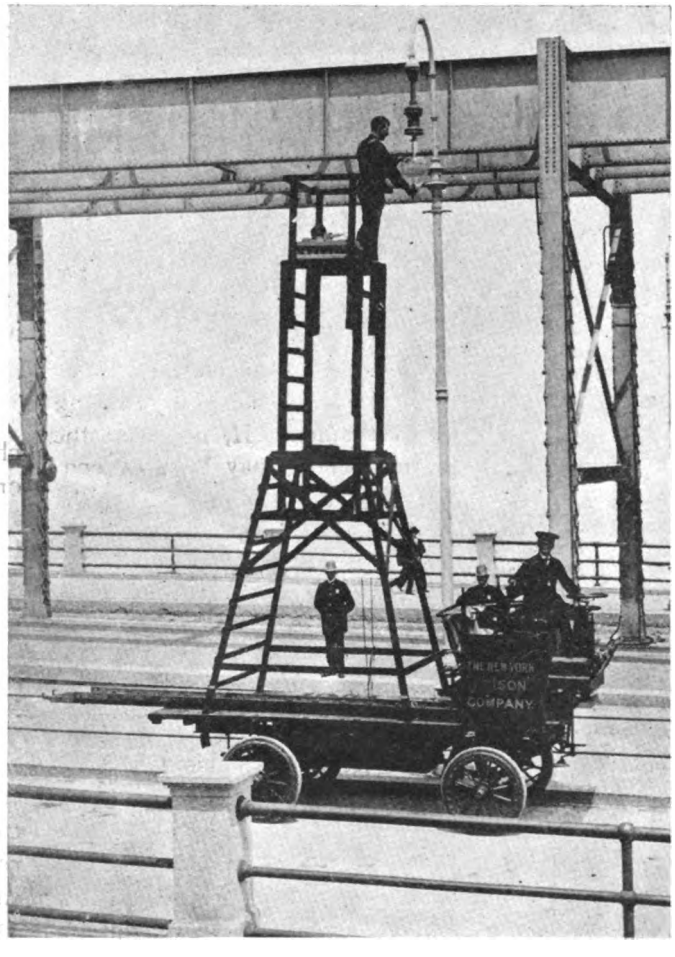
TAXING MOTOR WAGONS

IN one of the rural districts of England the authorities hold the opinion that power wagons do serious and exceptional damage to roads. Therefore it is proposed to tax them at the rate of 4 cents per mile for the use of the highway. When motor wagon users protested against this tax, saying that it represented the difference between railway and power wagon economy, they were informed that it was to the interest of all tax payers to stifle motor traction on the roads, as every ton of traffic taken from the railways lessened their taxable value.

This naturally much incensed users of motor wagons, particularly as they had learned that the local railway had requested the assessor to reduce its assessment from $270,000 to $125,000. It further developed upon investigation that this same railway company had succeeded in obtaining assessment reductions in excess of 20 per cent in other rural districts through which its lines passed. The incident furnishes a fair illustration of the prejudice which has to be overcome before the employment of power wagons can become universal.

The motor buses used in England for long distance travel are fitted with smoking compartments, but have no roof seats.

The Birmingham Railway, Light and Power Co.'s two-ton truck, described and illustrated in the May 31 issue of this paper, is used in delivering coke in bags. The superintendent of the company's gas department says the motor wagon is a decided improvement over the horse wagons heretofore used.



Trimming Arcs.

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Millions for Motor Buses

Expense of Maintenance Greatly Increased Owing to the Lack of Spare Vehicles

BEFORE this year of grace is spent there will be about 1,000 motor buses on the streets of London, representing an investment conservatively estimated at $4,000,000. Up to May 18 the number in service was 432.

Operating companies are impatient over the delay in executing orders for vehicles, the traffic demands being so heavy as to force them to keep nearly all their buses in active service, with the result that few are available as "spares" when thorough overhauling becomes necessary. It is expected, however, that as the season advances manufacturers will be able to expedite deliveries and thereby relieve the situation. Meanwhile the vehicles are being given only such attention as the adverse conditions would imply. Under these circumstances it may readily be understood that the expense of maintenance is not as low as it would be if the buses were given adequate stable care. It is also obvious that charges for depreciation are much higher than normal.

The last census reveals the following information:

OWNERS.

London Motor Omnibus Co., Ltd.	110
London Road Car Co., Ltd.	70
London General Omnibus Co., Ltd.	69
London and District Motor 'Bus Co., Ltd.	38
Thomas Tilling, Ltd.	24
Great Eastern London Motor Omnibus Co., Ltd.,	20
Star Omnibus Co., Ltd.	18
Associated Omnibus Co., Ltd.	17
London Power Omnibus Co., Ltd.	15
Birch Bros., Ltd.	11
New London Suburban Omnibus Co., Ltd.	8
Victoria Omnibus Co., Ltd.	7
Henry Turner	5
Patrick Hearn	5
Other owners	15
Total vehicles in use	432

MAKERS.

Milnes-Daimler	179
Straker-Squire and Bussing	103
De Dion	53
Durkopp	28
Stirling	15
Brillie	13
Leyland	12
Clarkson	11
Orion	9
Germain	2
Dennis	2
Other makers	5
	432

Incandescent Lamp Truck on the Way from Harrison, N. J., to New York City.

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Traveling Men's Cars

Utility, Convenience and Economy of Automobiles for Traveling Salesmen

BEFORE long we may expect to see the automobile extensively employed by traveling salesmen in territories where roads are good and towns not too far apart. Even in sparsely settled districts they can be expected to yield advantages not forthcoming by the use of any other means of transportation. There is nothing problematical about their economy in work of this kind, for in almost every state in the Union one can point to firms which long since demonstrated the value of having their road representatives independent of railroads. While these concerns are not making a great noise over the utility, convenience and economy of their cars, it is evident from the regularity with which they add to their numbers that they are giving ample satisfaction.

The cost of operating a traveling salesman's car for any given period will vary, broadly speaking, as the distance, speed and load fluctuate. This statement purposely ignores the gradations in skill among operators and the unequal highway conditions which are necessarily encountered. Repairs and fuel being the chief items of maintenance, are costly, as speed and distance become desirable. There is plenty of testimony to prove that doctors and city salesmen can cover their routes in a motor car with much less expense, and far more expedition (in itself no small economy) than by any other mode of conveyance. To be sure, some have found it more costly than others, but that proves nothing to people who are accustomed to note the variations resulting from every kind of human performance. Some folks expend more energy in walking the length of a block than others do in marching a mile. Machinists do not always obtain the same amount of work from an automatic tool. The personal equation in driving and caring for an automobile, as in everything else demanding human attention, determines the result.

An average, however, may found from the experience of the skilled and the unskilled. A certain firm making a specialty of supplying 10 hp. gasoline cars for traveling men considers that $200 is a fair expenditure for the upkeep of a vehicle which is driven 5,000 miles over city streets which are in an ordinarily good state of repair. The estimate is high, if the experience of a city salesman noted below safely indicates what the expenditure ought to approximate. This man, a novice at driving a motor car, covered a little more than 39 miles a day for 131 days, or a total of 5,192 miles during the period. Gasoline was bought at wholesale by the firm employing him.

Fuel	$ 54.52
Lubricant	15.42
Waste, etc.	3.30
Renewals and repairs	44.72
Sundries	4.74
Total	$122.70

Distance traveled, 5,192 miles.
Gasoline mileage, 16.74 miles per gal.
Cost per mile, 2.362 cents.
Cost of motor car, $850.

Of course, nobody expects that the car will continue to operate at this low cost. Tires must wear with service and eventually be replaced. Prolonged service, too, will necessarily impair the whole vehicle structure. To cover these and other items of accounting charges for depreciation and interest on investment should be made, but even with such additions the economy of the automobile in commercial work of this class is still in evidence when one considers the expenditure which would be required to convey a salesman so far or so fast by any other available means.

Mobility, the convenience of the automobile for carrying samples of merchandise, and many other features of service which will readily occur to those who could and do employ motor cars in service of this character, are not dwelt upon for the reason that they are too obviously implied.

Abroad—in England, France and Germany—commercial travelers' motor cars are widely used. There, however, the closeness of the towns and cities, together with the superior condition of the highways, compel attention to the value of the automobile as an agent of commerce. There is a particularly brisk demand in England for salesmen's cars, the bodies of many being contrived with more ingenuity for the convenience of the traveler.

MOTOR BUSES IN ROME

EVEN Rome, the Eternal City, has been invaded by the motor bus. The historic Corso, the one street of importance on which the street railway is not operating, has been selected as one of the principal routes for the motor vehicles.

Add Edinburg to the list of municipalities which are modifying their programs for suburban street railway extensions, owing to the introduction of the motor bus.

Lamp Renewal Wagon.

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Information to Buyers

SEVERE TEST OF BIG TRUCK—Recently the Kansas City Motor Car Co., Kansas City, Mo., tested one of its 60 hp. six-ton gasoline trucks over country roads from Chicago to Kenosha and return, a distance of 271 miles. The trip lasted six days. The actual running time from Chicago to Kenosha was 8 hours and 45 minutes. In some places the roads were in very bad condition, nothing but mud and water; at one point new cinders 1 1-2 feet deep had been distributed for about four blocks. There had been but very little travel over this road, and that by vehicles of the standard gauge. Nearing Kenosha, the main bed of the road is very narrow and covered with three or four inches of sand, with mud and water on both sides. Demonstrations were made for the merchants in Kenosha. The truck, loaded with six tons of barrel salt, pulled up a steep grade.

TRUCKS FOR LOS ANGELES—The Knox Motor Truck Company, of Springfield, Mass., recently shipped a carload of trucks to Los Angeles, Cal., these being the first shipment on an order of twelve which are to go there. The shipment included two three-ton trucks and one two-ton truck. The company is also shipping a watering-cart to the park commission of Boston, for use on the state park reservation.

A DELAWARE ENTERPRISE—The Delaware Valley Transportation Company has been organized for the purpose of operating passenger and freight motor cars between Port Jarvis and Stroudsburg, Del., by way of Milford and Bushkill, a distance of 40 miles. The vehicles to be used in the service are made by The Mack Brothers Auto Car Company of Allentown, Penna.

ANNOUNCEMENT—The General Vehicle Company, incorporated May 26, 1906, under the laws of the State of New York, has purchased the entire manufacturing plant and patents of the Vehicle Equipment Company, and is prepared to execute orders for commercial vehicles of the latest design as well as to furnish parts for repair or renewal of any carriages, wagons or trucks heretofore built by the Vehicle Equipment Company.

NEW FACTORY—The Whitney Mfg. Co., of Hartford, Conn., has awarded a contract for the erection of a new factory building which, it is expected, will be built by November 1. The building will be on an 8 acre tract. It will be 228 feet long by 61 feet wide, four stories high, which, with a single story extension, will give a floor area of about 62,000 square feet. The building will be constructed of reinforced concrete. The arrangement of floor space, elevators, shipping and receiving facilities will be such as to insure economical manufacture. The Whitney Company makes chains for motor cars. It also manufacturers milling machines, grinders, keys, and cutters, chucks, collets, and frictional tapping devices.

Pressed Steel Truck Frames
The
PARISH & BINGHAM CO.
CLEVELAND, OHIO

THE COMMERCIAL TRUCK
cannot afford to have anything but the BEST. The ignition is undoubtedly the heart of the power wagon.

THE SPLITDORF COIL
is universally acknowledged the BEST. You cannot afford experiments.

(Made in America since 1858 in the Splitdorf Laboratory).

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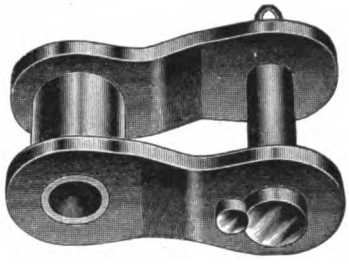
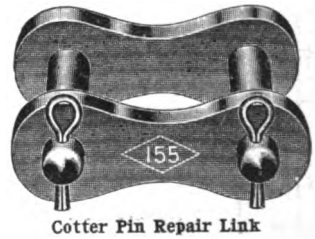

Offset Repair Link

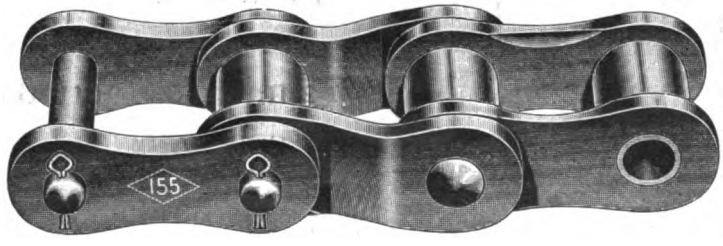
"DIAMOND" REPAIR LINKS

A quick method of repairing a break or adding links when changing ratio of gears



Cotter Pin Repair Link

NICKEL STEEL
—
RIVETS
REAMED HOLES



Combination—Offset—Roller and Repair Link

50-CARBON
SIDE STOCK OF
SPECIAL ANALYSIS

A NEW "DIAMOND" CHAIN

and a Set of Repair Links should be carried in each tool kit. Quite as important as an extra tire.

CHAIN DRIVE vs. GEAR DRIVE

You can carry an extra chain and parts, but not a set of Gears. You can repair a chain on the road; bevel gears must go to factory. Any driver can adjust a chain; it requires skill to adjust gears.

Diamond Chain & Mfg. Company INDIANAPOLIS
243 W. GEORGIA STREET

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Motor Mail Wagons

Detroit Postmaster Points Out Advantages of Motor Vehicles in Rapid Mail Transportation

GOVERNMENTAL use of motor vehicles is a subject which, regrettably, is attracting too little attention in this country considering how extensively and advantageously they are employed abroad in postal, military, naval and other branches of national service.

It is unfortunate that many of the experiments conducted by our departmental authorities were made at a time when automobile design was emerging from darkness and converted touring cars, far inferior to those manufactured today, were regarded as possessing all the elements required for the economical operation of industrial vehicles.

The memory of these follies no doubt intensifies the natural conservatism of government officials when any project to make use of power wagons is presented for their consideration. One department alone—that controlling the transportation of mails—is apparently willing to overlook the errors of the past and concede that the art of motor vehicle building is now in a very advanced state.

Expedition and certainty of service are the two qualities to which administrators of our postal affairs attach the most importance. As it is evident from thousands of well ordered services in commercial life that the power wagon is lacking in neither of these functions, one is not surprised that the sentiment against its employment in postal work should be rapidly disappearing, and that even rural mail carriers are now permitted to make use of automobiles where the physical aspects of the country are favorable to their use.

Early last April it was decided to aid the postal service in Detroit by a motor wagon which is employed to carry mail between the main office and station F, distant about 4 1-2 miles. Seven round trips are made five days a week; four trips are made on Sunday, and six on Saturdays. The total weekly mileage, therefore, is 405 miles. The average time required for the round trip of 9 miles is about 17 minutes. The weight of the load varies from 100 lbs to 500 lbs. The vehicle is especially constructed for postal work, and in providing for the security of the mail conforms to the requirements for the regulation screen mail wagon. The space for carrying the mail is entirely enclosed. The roof is rain proof. The vehicle is fitted with side curtains and doors which lock when closed. The carrying capacity of the wagon is slightly in excess of that of an ordinary screen wagon.

To a representative of *The Power Wagon* the postmaster of Detroit made the following statement concerning the performance of the vehicle:

"Of course no comparison can be made between the quality of service performed by the old fashioned horse-and-screen-wagon and the automobile. It would take 55 minutes for a horse and wagon to cover the route that the automobile covers in 17 minutes. It would seem that the only device which can compete with the automobile in the rapid transportation of mail from a main post office to stations, is the pneumatic tube system; and the cost of the tube service would be immensely greater than automobiles. The annual rental paid for a single mile of the tube would be greater than the cost of automobile service over a route ten times as long; and in a city with good pavements and wide streets, the quality of the work performed by the automobile would be at least as desirable as that of the tube.

"During the month of April we had a number of storms and a great deal of wet, slippery pavement. Not-

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withstanding this, the automobile maintained its schedule in fine shape throughout that time. During the month of May the service has been almost perfect in regularity and punctuality."

The wagon is operated for the post office by the Auto-Express Co., of Detroit, an establishment which has built up a very extensive motor wagon package delivery business. The gasoline consumption is about one gallon for every 19 miles, and the lubricating oil consumption about 1 pint for every 17 miles.

STATE OPERATED BUS AND FREIGHT LINES

A COMPREHENSIVE report on state and state-assisted motor bus and motor wagon lines has been presented to the Bavarian Diet by the Minister of Traffic. It is pointed out that in passenger service the motor bus has the following advantages over horse-drawn vehicles: double the speed; 50 per cent reduction in fares; more frequent journeys. By employing motor wagons for freight traffic a saving of 20 per cent is effected.

The minister reviews the service of a few motor bus lines which are operated on a flexible schedule to suit local requirements. He finds the entire cost per kilometer is 13 cents. To relieve traffic pressure trailers are employed. The establishment of motor bus lines is urged in districts where the expense of constructing a railway would not be warranted. In concluding the minister takes exception to the entire costs being covered by taxes imposed on the tax-payers collectively, arguing that the advantages would be enjoyed by a comparatively small group of interested persons. Hence, he recommends that the state's share in the expenses should be confined to the working costs, parishes, associations, and other interested bodies being responsible for the expenses of plant, interest on capital, and wear and tear.

INDUSTRY OF HUGE PROPORTIONS

THE enormous sum of $9,800,000 has already been invested in London motor bus companies. At the last census taken it developed that 453 vehicles were in service, being an increase of 21 within a week. The figures now stand as shown below:

London Motor Omnibus Co., Ltd.	115
London Road Car Co., Ltd.	72
London General Omnibus Co., Ltd.	71
London and District Motor 'Bus Co., Ltd.	38
Thomas Tilling, Ltd.	26
Great Eastern London Motor Omnibus Co., Ltd.	25
Star Omnibus Co., Ltd.	20
Associated Omnibus Co., Ltd.	18
London Power Omnibus Co., Ltd.	16
Birch Bros., Ltd.	11
New London Suburban Omnibus Co., Ltd.	8
Victoria Omnibus Co., Ltd.	7
Henry Turner	5
Patrick Hearn	5
Other owners	16
Total vehicles in use	453

In Service in Detroit.

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Labor Saving Methods

Illustrations Which Emphasize the Value of Power Wagons as Labor Saving Machines

BEFORE long certain minor economies to which the power wagon gives rise will compel radical changes in the methods employed by large establishments for handling, loading and unloading merchandise. Existing methods, which are extremely wasteful of human labor, will largely disappear when it is generally recognized that the motor vehicle possesses other conspicuous advantages than those we are accustomed to witness.

In Syracuse, for example, a large manufacturing establishment, which only awaits the erection of its new building before making extensive use of power wagons, is so keenly alive to the necessity for facilitating the loading and discharging of material that its elevators are being constructed of suitable length, width and strength to accommodate loaded motor wagons, which will be maneuvered onto the elevator platform. This is a refinement of practice which in a few years will doubtless be rather common in establishments whose shipping and receiving departments are unusually active.

Practice of this kind is not without precedent. Many miles of streets in the down-town districts of Chicago, are tunnelled for the passage of railroad freight cars which are drawn to the surface at large wholesale establishments, and the merchandise they contain unloaded with three or four less handlings than would be required to unload the freight in the railroad yards and haul it by the customary methods of transportation.

Another minor economy of the motor wagon is called into action when the power plant of the vehicle is made available for performing work which is now laboriously accomplished by humans. A nice example of the utility of the power plant was featured in an article which recently appeared in this paper, dealing with the handling and transportation of heavy roll paper for the International Paper Company. It will be remembered that a characteristic of this device was the limitations which it put upon the load, excessive overloading being practically prohibited by the overhead location of the hoisting cable.

Money safes, pianos, and merchandise of similar bulky and weighty character, can advantageously be handled by means of a suitable power operated hoist. Washington officials are well aware of this, a fact clearly evident from the specifications for the construction of a wagon which is about to be purchased for the transportation of paper money from the printing office to the national treasury building. The power plant of this wagon will lift the safe in which the money is contained from the street level to the platform, which is fitted with steel runways inclined toward the front of the vehicle, thus enabling the load to be put into position without expenditure of human energy. The trap door at the end of the platform, through which the safe is hoisted, will close when the wagon is loaded, and the space which it occupies be used by the armed guards which usually accompany the delivery. Unloading of this vehicle is also to be accomplished by means of its power plant.

For some years past the utilization of the power plant of motor wagons has been employed to aid vehicles in ascending heavy grades, one end of a steel cable being fixed to some permanent roadside object, and the other winding on a drum on the vehicle.

These are but a few of the many subordinate uses for vehicle motive power. They are mentioned merely for the purpose of indicating that the value of the modern wagon does not end with the performance of road service, as in the case of the horse-drawn wagon, but is capable of work which rightfully entitles it to be classed among the labor saving inventions of the period. All its economies are not seen at a glance.

SPEEDY SERVICE IS DEMANDED

THE chief of Cincinnati's police, who for a long time has been quietly urging the employment of motor ambulances, is now clamoring for them. Quite recently a number of people were killed and wounded in a collision. In the efforts made to speed the survivors to the hospital the inferiority of horse-drawn vehicles for emergency work of this character was well demonstrated. The chief, commenting on the inadequacy of the present service, remarked:

"In such events, especially in the case of a terrible accident when there are many injured, every instant is precious and may mean life or death. There were four patrol wagons ordered to the scene of the recent disaster, but only one could reach there in reasonable time, and that was Patrol 8, which had to run down the hill. The long climb up Vine street hill for the other patrols caused an aggravating delay. *When the horses reached the scene of the accident they were exhausted.*

"Now if we had emergency automobiles or regular automobile ambulances, they could have shot up the long hill without any trouble, reaching the place in one fifth the time it took the patrols. Inspector Casey and myself rode there in Patrol 1 as soon as he got a flash about the accident, but to show you the difference, when we were starting up the bottom of the hill, the Salvage Corps automobile passed us on their way home. They had been up the hill, done what they could, and started back. We ought to have an automobile for the department, and we never had it more vividly brought to mind than yesterday."

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Stable Adminstration

System Which Penalizes Drivers When Service of Vehicles is Interrupted

SOME instructive facts concerning the wages paid to motor bus drivers and conductors, their hours of employment, and the duties required of them, have come to light as a result of an abortive attempt to provoke a strike among the men employed by one of the largest public service companies in London.

It appears that the company has 115 vehicles in active commission. The men were apparently well content until a discredited "walking delegate" formulated the following demands:

1. That wages be paid weekly on a basis of $1.68 per day for drivers, and $1.44 per day for conductors, for a maximum working day of 9 hours and 40 minutes, from which 40 minutes shall be allowed for one square meal about the middle of the working day. That they shall have every other Sunday off, and the working day on Sunday shall be 13 and a half hours maximum, less one and a half hours for meals. The payment for same to be $2.60 for drivers, and $2.22 for conductors.

2. The abolition of all punishment by suspension or discharge for low earnings.

3. When a car breaks down on the road, both drivers and conductors to be paid a full day's pay.

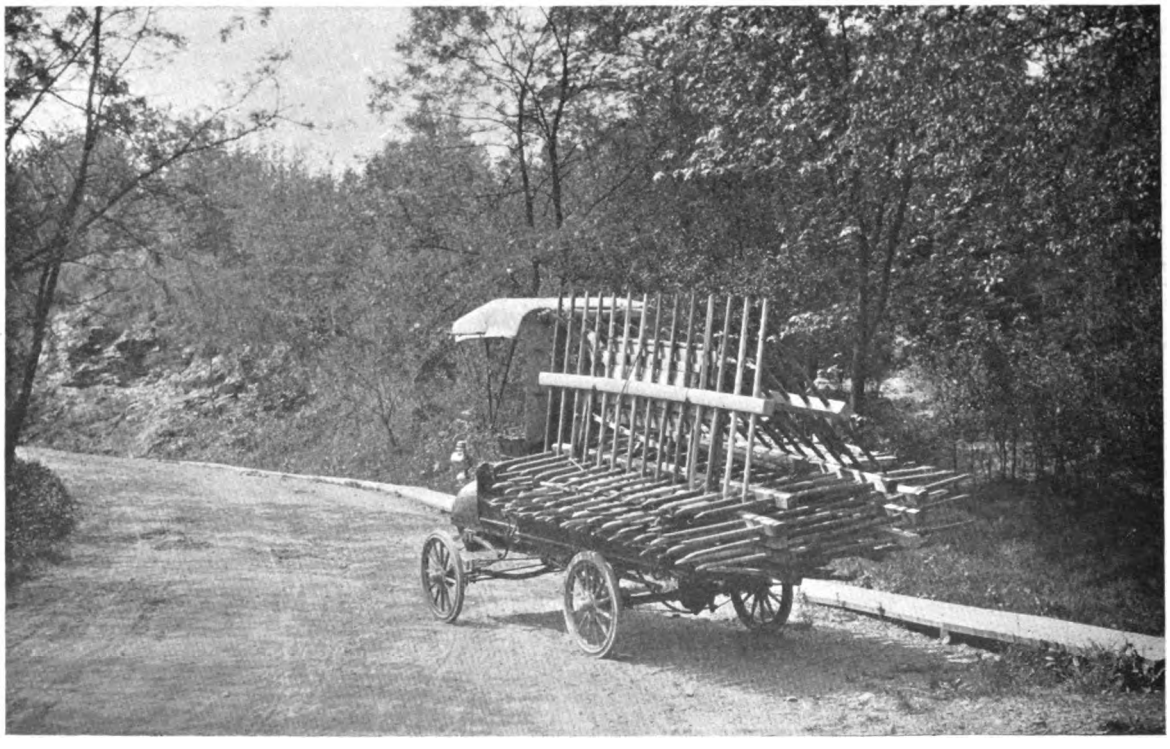
4. When cars are in garage all day, drivers to be paid 14 cents per hour and conductors 10 cents per hour for the usual working day.

Justifying the work conditions which prevail, the manager of this company remarks:

"Our drivers receive $1.62 per day, and our conductors $1.38 per day, for an average day of less than 10 hours. A time-table is arranged so that the buses only need to travel at an average of 6 3-4 miles per hour. It will be obvious that, in the majority of cases, the men have sufficient spare time at the end of each double trip to look after their own personal comforts in the matter of food, drink, etc. There are, naturally, instances where delays arise, and when, perhaps, the men only have a few minutes in hand or nothing at all; but, taking one week with another, there is no hardship. The men who attend to horse-drawn vehicles work from 15 to 16 hours a day, and have no longer for their meals than our men. We have arranged for the men to have every other Sunday off, and their pay is on a liberal scale according to the service.

"Any question of low earnings is, of course, not one of honesty; that is automatically checked by our ticket system. When we find that a conductor's takings are as much as $5 to $10 a day less than the normal, and when we find that this bad result persists, it is obviously fair to other men that a lazy conductor, who neglects to pick up his passengers and to serve the public as he ought to do, should be penalized.

"The demand for full pay when a car breaks down shows an ignorance of mechanical traction. For several weeks past we have been paying our drivers 14 cents an hour during the time their vehicles are off the road, compared with 16 1-2 cents an hour while in active service, and we perfectly well recognize how desirable it is that the men should not be called upon to suffer a more serious loss of wages than is indicated by this difference. It is



Logan 10 hp. Wagon Going Up 18 per cent Grade With 1500 lb. Load of Hay Rakes.

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subversive of all discipline that an unconditional system of full pay should, *nolens volens,* be accepted by us, and the public would quickly find that the services would be demoralized if such a method of working were adopted."

The point at issue in the fourth demand is being considered by the management. It will likely be conceded.

Some drivers work 16 hours a day, but are given one day off in every three, while they are only required to work four days every third week.

The company reserves no less than six of its vehicles for training drivers to their duties, no fee being charged. Each driver who was employed to train these men draws $13.20 a week. Each of these buses, if put into service, would earn in the neighborhood of $250 a week.

WHERE SPEED IS DESIRABLE

THE West Side Livery & Transfer Company, of Cleveland, operates two Logan motor wagons in its light delivery and transfer service. The company confines its operations to the transfer of trunks and packages from one portion of the city to another on "hurry-up" calls. It carries trunks from hotels to railway stations and boat landings, a service which necessitates quick delivery. The majority of its orders come over the telephone.

Formerly the company had five horse-drawn wagons in this service, but found that power wagons not only do a great deal more work, but do it with more expedition. The machines are averaging over 60 miles a day, which is more than three horse-wagons could do and keep it up day after day. A run with a trunk to some distant part of the city, which formerly required an hour or more, can be made in 25 or 30 minutes.

Asked about the expense of operating and maintaining the motor vehicles, the manager of the concern said that this was a matter which concerned him but little. The superior speed was the feature that counted. He is advertising quite extensively and the business has increased considerably owing to the superior character of the service. The machines average 15 miles to a gallon of gasoline, the usual consumption being about 5 gallons per day and one quart of lubricating oil. Repair expense is light. The drivers are comparatively inexperienced men. Machines are fitted with heavy coil spring shock absorbers in connection with the ordinary elliptical springs.

FIVE YEARS FROM DATE

MAN has sometimes used horses so long that the thought of dispensing with them causes a rebellious feeling. The supplanting of the horses by electricity in street car service has done a good deal to help the motor business. It is not difficult for those who keep in touch with the trend of the times to predict that in five years horses hauling heavy loads in the city will be a rarity. Large transporters of goods must soon awaken to the importance of replacing horses with motor wagons on the score of economy. For the general public, the benefit in the cities especially will be much, as the streets will be free from filth and dirt, caused by horses, which easily is 90 per cent of the accumulation that now keeps roadways in disorder.—*Chicago American.*

GOOD FIELD FOR MOTOR BUSES

TO meet the growing demand for adequate transportation facilities between Elizabeth and Rahway, N. J., and especially between these towns and the borough of Roosevelt, the East Jersey Motor and Transportation Company has been organized with a capitalization of $100,000. It is composed of men who realize the enormous possibilities that the field presents, not only in transporting the present population, but in building up a section practically stagnant for lack of transportation facilities. The company has purchased three motor buses and will begin active operations at once. At present Roosevelt is without means of communication with the surrounding cities except by the New Jersey Terminal Railroad, which connects with the trolley line a short distance from Rahway, but as this line only runs two trains per day it is valueless as a public carrier.

FORCEFUL EXAMPLE OF ECONOMY

AKRON, Ohio, was the first city in the country to use a motor police patrol wagon. In the time the machine has been in service it has paid for itself twice over. The cost of operation and maintenance is about 60 per cent less than the expense which attended the operation of the superseded horse-drawn wagons. Taking note of this, the board of public safety now contemplates the installation of motor fire engines and hose wagons.

"Hurry-Up" Transfer Wagon

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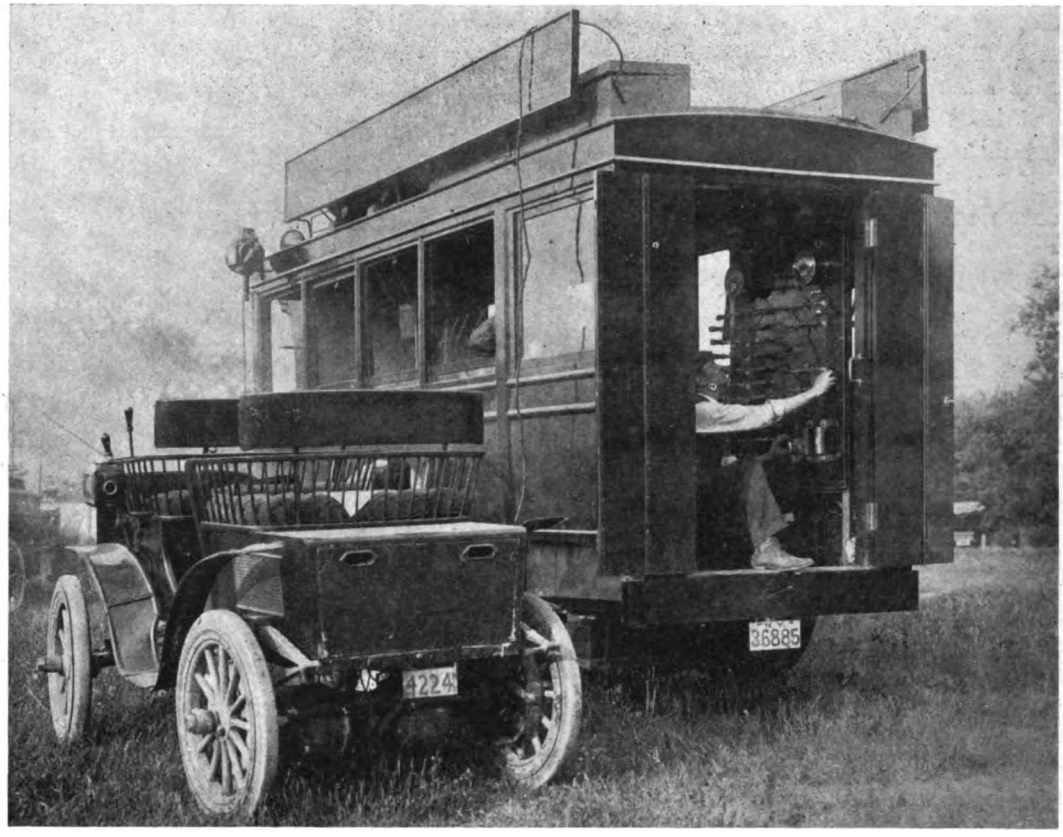

Portable Charging Plant

Useful Service Performed by Special Vehicle Which Supplies Supplementary Power

BATTERY mileage of electric vehicles can occasionally be considerably extended if conveniences such as are employed by the New York Transportation Co. are provided for supplementary charging. The company's charging wagon follows its public service vehicles to all points where they are likely to be found in quantity, such as race tracks, etc., supplying them with energy to replace what was expended during the out-going trip. This wagon is equipped with a six-cylinder gasoline engine and dynamo.

The vehicle is a compact but ponderous affair, weighing about ten tons and having a maximum speed of about 8 miles. Its chassis is unusually strong. The gasoline engine develops 75 hp. at 800 revolutions and transmits its power to a generator from which current is drawn to propel the vehicle.

Engine cooling is accomplished by two radiators placed on the roof of the vehicle, with a water tank between. Two fuel tanks are located alongside the radiators. A tool chest is located at the rear end of the roof.

The switchboard is at one side of the entrance to the vehicle, the resistance being on the opposite side. Current is utilized with batteries under charge either in series or multiple. Current measuring instruments are placed in a row on top of the switchboard, while the switches controlling the outlets, of which there are twelve, are ranged one above the other on the left hand side of the board. The ammeter on the left side of the switchboard is connected in the circuits represented by the six upper switches, that on the right with the lower six. The voltmeter is located between the two ammeters.

The voltage generated varies from 230 for charging to 150 for the driving motors.

The rear wheels are 53 inches in diameter, equipped with twin solid four-inch rubber tires, held apart at their centers by a steel ring. This form of tire equipment minimizes the tendency to skid.

The two driving motors are hung very low, being within eight inches of the ground.

It will be readily observed that the vehicle is much better equipped than any lighting plant to which the company's service vehicles might go for power replenishment when performing long distance duty.

LONG DISTANCE MOTOR CAB RIDES

LONG distance motor cab rides are now matters of every day occurence in London. Runs to Brighton and Windsor are frequently made but the record is held by a cab chartered by an officer stationed at Colchester. Having to be early on parade the next morning and missing his last train, he took a motor cab for the journey of 104 miles. The driver received $26 for the long night journey.

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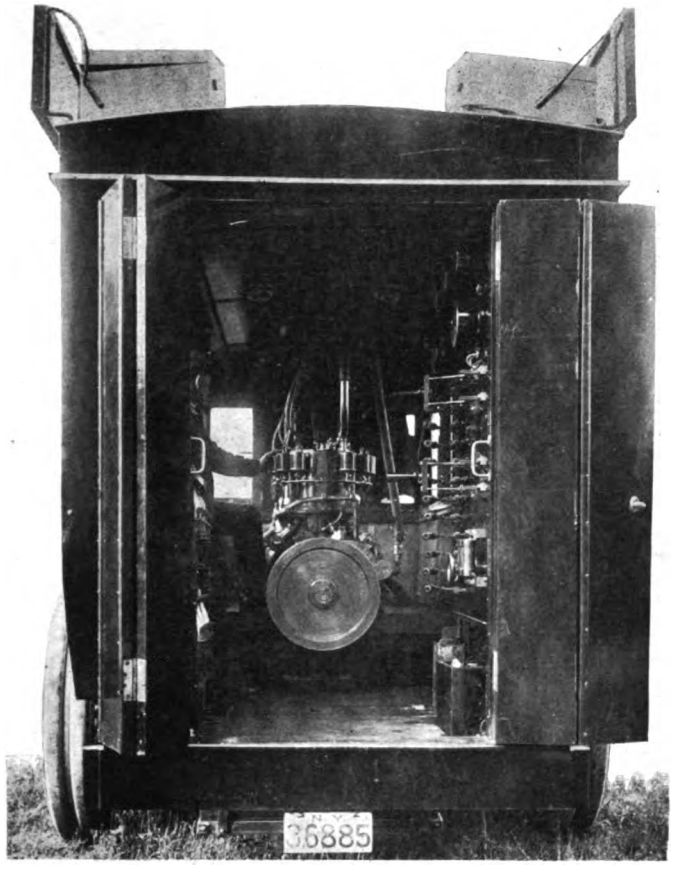

Interior of Charging Wagon.

TOURING MOTOR BUSES

VISITORS to the Bavarian uplands will hereafter enjoy the pleasures of motor bus touring. A special committee has been appointed for the purpose of establishing motor services over the attractive stretches of country in the district. At the inaugural sitting of the committee prominent authorities attended, among them the president of the Imperial Council and the director of the Imperial Post, who promised to further any practicable scheme proposed. The suggested services will include the transport of goods.

BUS SERVICE EOR PHILADELPHIA

MOTOR bus competition threatens the electric street railway lines of Philadelphia. Only the sanction of the City Council is needed to enable the People's Vehicle Company to begin operations.

A bill authorizing the department of public works to issue licenses to the promoters of the plan has been approved. According to the bill, the rate of fare will be 5 cents, six tickets to be sold for 25 cents and twenty-five for $1. Public school children will be carried for a 2-cent fare on Saturdays, between 8 a. m. and 4 p. m., on all vehicles running to and from Fairmount Park. They will also be carried for the same fare on other days between 9 a. m. and 3 p. m. when accompanied by their teachers.

The company agrees to pay a license fee of $100 for a vehicle having a seating capacity of twenty passengers, $150 for a thirty and $200 for a forty passenger omnibus. A thirty-year franchise is desired, with the understanding that the city may at the termination of that period renew the franchise for a like time or else acquire the stock of the concern at its appraised value.

An automobile passenger line between Ripon, Wis., and Green Lake, a distance of six miles, will be in operation this season.

Charging Wagon at the Race Track.

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Importance of Lubrication

High Efficiency of Public Vehicle Service Ascribed to Care Exercised in Lubricating

CONSIDERABLE difficulty is experienced by stable executives having charge of large installations of motor vehicles in training attendants or operators to properly lubricate the working parts of the machines. The chief engineer of a large public vehicle service, who has met with a greater measure of success than can be credited to the majority of administrators, accounts for his ability to keep 92 per cent of his rolling stock in constant service by the degree of care he exercises in this important particular of maintenance. As the company he serves has 72 machines in active operation it becomes worth while to study the methods he employs to gain such remarkable efficiency. He is reported as saying:

"In some of the vehicles under my care the engine and gear box are lubricated by oil feeders, into which oil is put during the day, the oil going down the pipe by its own weight. In another system the pressure of the exhaust, or of an auxiliary hand pump, is used to force the oil from a tank to the engine and gear box, the tank usually being placed on the dash, with a main tube, from which the pipes are led to supply oil to the engine bearing. Other cars are oiled by a system similar to that adopted with the Dubrulle lubricator, as far as the engine is concerned, and yellow grease is supplied to the gear box and other bearings. This means that three different systems exist, viz., gravity, pressure, and mechanical. Let us now study the disadvantages of each of these systems:

"GRAVITY.—This system depends for its supply on the fact of there being oil in the tanks. In cold weather the oil is apt to become so thick that it cannot pass through the pipes, and the bearings are therefore not lubricated. I have given special attention to the question of the lubricating of my cars, and my experience in this matter, which is extensive, forces me to the conclusion that the only way to get over the difficulty is by the use of a thin oil. After trying the oils of five of the most important firms I now use one that runs like water, so that I am sure it passes through the pipes.

"PRESSURE.—This method is absolutely bad when the exhaust to the engine is used to obtain pressure. All the burnt oils pass through the pipes, which are choked in a very short time, and are really troublesome to clean. The same trouble exists as in the gravity system when the weather is cold.

"MECHANICAL.—I have tried this system for six months, but have had to give it up, as the drivers were so careless that they did not even watch the running of the oil, and as a result I had more than fifty cases of engines running hot for the simple reason that the belt of the lubricator was lost.

"I have absolutely banned the use of yellow grease for two reasons, one of which is that the men apply the lubricant with any implement they find handy. An old piece of wood covered with grit or a piece of steel used by the washers to scrape the dirt from the wings is used without discrimination, with a result that anyone can realise. The second reason against the use of grease cups is that the drivers will not turn the lubricators, place them where you will, and at the end of the day the same quantity of grease will be found in the cups as at the beginning.

"To my mind there does not yet exist a rational system of lubrication, although I know some people will say this is not so, or is at least exaggerated. My idea of oiling cars is based on the following principles, which have been obtained from experience:

"Don't expect too much from a driver who is not a mechanic, and who does not understand anything in the

National Casket Company's Wagon.

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matter. The average driver does not even know where the oil pipes lead, nor does he realize that he is there to look after the lubrication of his car. I do not know how many times I took the trouble of adjusting all the oil feeders, one after another, only to find every one of them altered at the end of the journey, and the cars smoking at the exhaust. The majority of drivers know so little concerning lubricating (they do not even know which pipes lead to the engine) that I have been obliged, after adjusting the feeders, to seal them, so that I could see if they were altered.

"All the difficulties and trouble in the lubrication of the cars brought me to the following conclusion—that it is necessary to find a safe system of lubrication that a man cannot tamper with, and that does not demand his active supervision. At present a driver should only be asked to drive his car, change his speeds, and apply his brakes, for those three things give enough trouble without asking the men to look after the lubrication of the cars. After sad experience, I am led to favor the system now in use on several types of touring cars and some buses. I refer to that of forced lubrication by pumps placed inside or outside the crank case or gear case. This system is automatic, and certainly gives good results on motor buses. A simple gauge can be placed on the dashboard of the car to enable the driver to ascertain whether or not the pumps are working. This, I think, is really the proper method to adopt.

"At present seventy-five per cent of the breakdowns are due to the fact that the drivers mess about with the engines, take a part out here to clean it and another part there, and refit it badly, with the result that a breakdown occurs."

COMPARISON OF ECONOMY

A NOTABLE example of the economy of a power wagon may be witnessed any day in the delivery service of the Wissler Hardware Company of Chillicothe, Ohio. This vehicle has been in active use for the past three months. It is operated by a 10 hp. air cooled Logan engine and does as much work as two one-horse light-delivery wagons, covering 27 miles a day. For the month of May operating expenses were as follows:

POWER WAGON OPERATING COST

Gasoline, 54 gals. at 14 cents	$ 7.56
Lubricating oil	1.50
Repairs, etc.	6.40
Driver's wages	32.50
Total	$47.96

At present prices the average expense of operating a single one-horse delivery wagon in this service is as follows:

HORSE WAGON OPERATING COST

Boarding	$12.00
Shoeing	2.00
Repairs	1.80
Driver's wages	32.50
Total	$48.30

Thus it will be observed that the power wagon, doing twice as much work as one horse-drawn wagon, is effecting a monthly net saving of $48.64, out of which, of course, must come depreciation and interest charges, but which nevertheless will not materially reduce the economy as the same charges must be reckoned with for the horse-wagon installation.

As the first cost of the wagon was $1,000 this investment should be recovered within two years. After earning its cost it will, if suitable care is given to mechanism and equipment, have a higher earning power than formerly, even allowing for the accelerated rate of wear and tear which is the inevitable accompaniment of age in any machine.

Another highly interesting feature of the service of this wagon is the low wages paid to the driver. Probably this servant, a young man, was schooled in the local automobile factory to be quite as competent in the management and care of his vehicle as if he drew $75 a month and was dignified by the title of "chauffeur."

HIGH SPEED MOTOR FIRE WAGONS

THE fire department of Glasgow, Scotland, uses first aid motor fire wagons, carrying 12 men and fifteen lengths of hose and attaining speeds varying from 20 to 30 miles an hour. Power is supplied by 24 hp. gasoline engines. The service in which these vehicles are employed is very arduous. Very high speeds are only made at night, when street traffic is light.

EGYPTIANS TO RIDE IN MOTOR BUSES

TWENTY-SIX motor buses have been bought for service in Alexandria, Egypt. Tests with trial vehicles—conducted at the expense of the purchasers, by the way—have been in progress for some time. The machines will be operated by gasoline engines. Each will have a seating capacity for 36 passengers.

Sweeping Streets in Paris.

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Example of Wastefulness

Municipal Garbage and Refuse That is Being Collected at Heavy Loss

A HIGHLY instructive report on garbage and refuse collection and disposal was recently presented to the authorities of Columbus, Ohio, a city with a population of 160,000. Nothing in the document, however, impresses the investigator of municipal economy so much as the fact that the great advantages of power wagons are overlooked in work which confessedly is inadequately performed by draft animals.

For years the officials of Columbus have been deeply absorbed in the study of various civic improvements, among which the gathering and disposal of garbage and refuse occupies a prominent place. Recently opinion has crystalized, and the authorization of a bond issue to cover the cost of removing street filth is being urged in the council. The estimate for keeping the city clean is particularly interesting inasmuch as it supplies the first detailed engineering report upon the cost of providing a city with what is popularly regarded as an efficient system of garbage collection. The engineer who prepared it recommends that the municipality collect street refuse, rubbish and dead animals by its own employes, providing ample equipment and stable accommodation for the purpose.

Garbage and dead animals are now collected by the Columbus Sanitary Works Company, the wagon bodies being loaded on steam cars and the cars hauled 4 1-2 miles to a reduction plant. This service is being performed under a 10-year contract which has just expired, the contract price for the period having been $15,800 a year. It is eminently safe to remark that at any time within the past three or four years the cost of performing this work would have been considerably reduced if power wagons had been employed for the purpose. Certainly it would not have been necessary to call extraneous power to aid the motor vehicle in hauling to the reduction plant.

Last year the amount of garbage hauled to the reduction works was 16,221 tons. It is chiefly of interest to note, however, that the collections were incomplete, the service highly unsatisfactory, and on the face of matters, decidedly inferior to power wagon service.

It is estimated that the citizens of Columbus pay $30,000 a year to private scavengers who perform their work but indifferently well. If the experience which foreign municipalities have acquired in the removal of garbage and the cleaning of streets by means of power wagons be any indication of the economy which might be obtained by the practice of similar methods in this country, the tax-payers of Columbus and other cities are being denied common rights.

Night soil is removed by private contractors, whose work is supervised by the board of health. The maximum legal charge for this removal is 10 cents per cubic foot. From daily reports submitted to the board of health it appears that last year about 112,000 cubic feet or 39,000 tons were removed at a cost of about $10,000. It would be well within the proven facts to state that such removal could have been accomplished by power wagons at one-third of the cost.

One of the most notable features of the report deals with the method employed for removing dead animals. During 1904 as much as 350 tons of dead horse was toted to the reduction plant. This tonnage represents a mortality among draft animals so high as to cause amazement, considering the comparatively low number of horses which are at work in all kinds of service in Columbus, the number of deaths from one cause or another amounting to 553.

In the following table will be found statistics which graphically portray the constantly increasing labor of collecting and removing municipal garbage and refuse, the figures submitted being estimated to suit the growing population:

	1905	1907	1910	1915	1920
Population	160,000	176,000	202,000	254,000	320,000
Street sweepings, tons ...	57,300				
Ashes (if natural gas were not used), tons ..	64,000	70,400	80,000	101,600	128,000
Garbage, tons .	17,600	19,400	22,200	27,900	35,200
Rubbish, tons .	8,000	8,800	10,100	12,700	16,000
Manure, tons .	45,000	47,000	50,000	55,000	60,000
Night soil, tons	3,900	4,500	5,000	5,600	6,000
Dead animals, tons	350	380	420	470	500

With admirable perspicuity the municipal officer who submitted this report points out that the major cost of garbage disposal is the haul. This, after loading and including the return of the empty wagon, he puts at about 30 cents per ton mile. The most costly motor vehicle service known to power wagon economists is doubtless the transportation of passengers by motor buses, and from reliable sources of information we are enabled to state it does not exceed 24 cents per vehicle mile—vehicles loaded with about 2 1-2 tons of human freight—even when administrative expenses of the most unusual kind are reckoned in the accounting.

It has been shown over and over again that municipalities can haul garbage by motor wagons at a cost of about 8 cents per ton mile, where the haul is longer than one mile or thereabouts. The economy, of course, is to be looked for in the greater carrying capacity of the motor wagon, its greater speed, and the heavy reduction in the number of men required to operate motor vehicles in comparison with the number required to operate horse-drawn vehicles.

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Brushing Back the Tide

Horse Wagon Drivers Make Futile Display of Hostility Against the Power Wagon

A CORRESPONDENT whose communication is printed in this page undoubtedly has had occasion to observe the effect of the hostility of horse-wagon drivers to all forms of commercial motor vehicles and consequently does not hesitate to label it as one of the causes for the protracted demonstrations which manufacturers or their agents are called upon to make for the benefit of firms which seek knowledge concerning the economy of power wagons.

It would be base flattery to assume that for many of the multitude which goads and flogs unwilling beasts of burden the power wagon holds but slight hope of future usefulness in the calling which they have chosen. Calculate that for every power wagon put in service two, and sometimes three, horse drivers must find a new vocation; and no further logic is required to show why the modern city merchandise transportation vehicle borrows the hatred of the man behind the whip.

The futility of his antagonism, however, is too obvious to require much attention. It is a labor of remonstrance quite as ridiculous as that of the storied Saxon chief who undertook the heroic task of brushing back the tide with a broom. The majority prefer to hold the customary view of the flexibility of American labor, and believe that it is adaptable at all times, and under all conditions, to whatever service reasonably may be expected of it.

Unhappily at this moment horse-wagon drivers, to a moderate degree, possess the malevolent power to which our correspondent alludes, but it should not be difficult to make the cause of it so plain to their principals as to rob it of the power for mischief. The majority of business houses which contemplate the present or eventual employment of motor wagons have sense enough to perceive that a certain amount of ill will must necessarily be incurred from horse stable employees whose experience must be cast aside when a labor saving machine, like the industrial power vehicle, discounts their skill.

The fundamental thought in any study of the power wagon rests upon heavy reduction in wages to be accomplished by its employment. Occasionally superior speed of the vehicle fascinates a purchaser. At other times it is the advertisement which arises from its use that appeals in the most force. But the sober analyst of values refuses to be decoyed by either of these alluring attributes of the motor wagon. He calmly reckons how much he can lighten his weekly wage roll if one motor vehicle, with one driver, can deliver as much merchandise as two or possibly three horse-drawn wagons attended by the same number of men required for their operation. The conclusion, whatever it may be, invariably governs his choice.

The trouble with the average horse wagon driver is that he is needlessly sensitive to his lack of mechanical skill, judging therefrom that there is little likelihood of his ever becoming as proficient in power wagon operation as he is in handling the lines. Better men than teamsters have experienced the same feeling when confronted with the necessity for buying and operating an automobile. It should be enough for the average teamster to know that the large numbers of inexperienced horse wagon drivers employed by breweries, express companies, merchants of all kinds, and even horse drawn omnibus companies, have not encountered the slightest difficulty in teaching unfamiliar hands how to control power wagon mechanism. Some merchants even go so far as to say that the ability of power wagon drivers should be exclusively confined to the handling of the control levers, leaving to better men such work as requires genuine skill and a thorough understanding of the mechanism.

Converts to the use of power wagons are being made with such rapidity that it is idle to regard such trivial interference as may be caused by hostile horse wagon drivers as menacing to any interest but that which indulges it, and the period of this indulgence will be terminated the moment the employers of power wagons, and not the drivers, are convinced in mass of the economy of motor wagons in service for which their superior labor adapts them.

Two belated expressions of opinion on the uselessness of lengthy motor wagon demonstrations are appended, one of them embodying the text for the foregoing remarks:

NO TIME TO WASTE ON SKEPTICS

In our practice we find that it is far better to refer the intending purchaser, in all cases, to the user of a wagon. Our policy where a party desires a demonstration for a week is this: We draw up and sign an agreement whereby the purchaser binds hismself to buy the vehicle for the price specified, provided it does the work as stated by the maker and under the conditions as given. We find a great many people skeptical on the matter of motor cars for commercial work, and they will not under any consideration enter into such an agreement. Such people we leave entirely alone.

We have very strong views on this matter and think every man proposing to use a motor car should bear part of the expenses and take some of the risk. The writer has been a carriage and wagon builder for 20 years, and in that time the guarantee has always been sufficient to make a sale and satisfy the customer; and it is on the lines of the carriage and wagon builder's policy that this firm is selling its product. It is also on the lines of carriage and wagon building that we are building our cars.

We strongly advise not to give a demonstration of more than one day, except when the party getting it puts the wagon on actual work and pays an amount which the maker guarantees the car will not exceed in operating expenses.

MACK BROS. MOTOR CAR CO.

Allentown, Pa.

HOSTILITITY OF HORSE-WAGON DRIVERS

In our judgment a month's demonstration of a motor wagon should be ample to thoroughly demonstrate its practicability and reliability. We have found that parties having a wagon for demonstration are by no means backward in working it to its utmost capacity. Moreover, in many large establishments employing horse-driven vehicles, the drivers are bitterly opposed to the introduction of motor wagons, and are making it a point, if it lies within their power, to put the machine out of commission.

HARRY FOSDICK COMPANY.

Boston, Mass.

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Care of Storage Batteries

Practical Suggestions for the Proper Maintenance of Batteries in Electric Wagons

It is a common error to imagine that a battery stores electricity. Its energy is due to the chemical action of acid upon the plates, which are of lead and lead peroxide. The solution is incapable of acting upon the plates until an electrical current is passed from one plate to the other. This current decomposes the electrolyte; one of its constituent elements or radicals goes to one plate and the remaining constituent to the other; so that when the passage of the current ceases there are two chemical elements or radicals, with a tendency to unite, and upon combination energy is developed as an electric current, which flows in the opposite direction to the charging current. This flow of current continues until the cell is restored to its original condition. When this occurs the cell is said to be discharged.

TAKING BATTERIES OUT OF COMMISSION

Where a battery is to be put out of service for several months, and it is not convenient to give it the freshening charge every two weeks, it should be taken out of commission. It should first be charged until every cell is in a state of full charge. If there are short-circuited cells, they should be put in condition before the charge is commenced, so that they will receive the full benefit of the charge. Then remove the elements from the jars, separating the positive groups from the negative groups, and place in water for about one hour to remove electrolyte adhering to the plates; then withdraw the groups and allow them to drain and dry. The positives, when dry, are ready to be put away. If the negatives, in drying, become hot enough to steam, they should be again rinsed or sprinkled with clean water and then allowed to dry thoroughly. When dry the negatives should be replaced in the electrolyte (of from 1.275 to 1.300 specific gravity), care being taken to completely immerse them (two groups may be placed in a jar and the jar filled with electrolyte), and allowed to soak for three or four hours. After rinsing and drying, they are ready to be put away. The rubber separators should be rinsed off in water. Wood separators, after having been in service, will not stand much handling and had better be thrown away. If it is thought worth while to keep them they must be kept immersed in water or weak electrolyte, and in reassembling the electrolyte must be put into the cells immediately, as wet wood separators must not stand exposed to the air for an unnecessary moment, especially when in contact with plates. When putting the battery into commission, it should be treated in the same manner as if it were new, and the regular instructions for assembling and putting into commission a new battery followed.

HURRYING A CHARGE

If, in case of emergency, it is desired to charge the battery more quickly than usual, or, in other words, to hasten the charge, the early part of the charge is the time when the extra high rate should be used, the completion of the charge being accomplished at the low finishing rate, the same as in normal charging. Much injury can be done by "pounding" a nearly full battery at a high rate.

BATTERIES USED BUT OCCASIONALLY

If a battery is to stand idle for several days, it should first be fully charged; if it continues idle, it should be given a freshening charge once in two weeks at the finishing rate and the charging stopped when the cells begin to gas. Don't overcharge. A battery standing unused for some time may lose a part of its charge, due to local losses in the cells, which the freshening charges may not entirely overcome; for this reason several discharges may be required before full capacity is regained.

The "Empty" Wagon.

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Attention

WHAT may be good treatment for one leather-faced clutch may be bad for another. Some oils may ease the gripping of one clutch, while it may cause another to bind all the tighter. Castor oil, however, in addition to its advantages as a leather preservative, gives uniformly good results, particularly if it is well worked over the leather and the leather left out of contact with the metal portion of the clutch. The following morning, the leather should be treated with a tablespoonful of paraffin oil, when it will be found that the clutch can be slipped to any desired extent without burning.

HOW TO AVOID FAN BELT TROUBLES

Trouble is often experienced with the belts which drive engine cooling fans. It can be wholly avoided by fitting a steel spring belt having an outside diameter of from ½ inch to ⅝ inch. With such a belt, no adjustment is necessary, for the slight tension placed thereon when first fitted is sufficient for all practical purposes, and it has the advantage that very little wear takes place on the fan bearings due to the pull of the belt. To obtain a quiet drive with this belt, it is necessary to arrange the belt pulley groove at a very sharp angle, otherwise the belt has a tendency to bottom thereon and cause a noise at every variation of the engine speed. To show the efficiency of this spring drive, it is only necessary to say that in several cases where a small dynamo is used for generating a constant current to feed accumulators and light tail lamps, the spring drive is found to be quite satisfactory, and very little slip takes place between the driving belt and pulley.

PRESERVATION OF TIRES

Grease is one of the chief enemies of rubber tires. It acts on rubber as a solvent. Rub vaseline on an old pneumatic tire cover and notice how quickly it will swell and how easily it can be rubbed to powder with the fingers when it becomes dry. If lubricators on the wagon are placed in such a position as to make it likely that drops of oil will fall on the tires, the utmost vigilance should be exercised to minimise the danger. It is also necessary to take care that the moving parts of the machinery do not cause oil to squirt on the tires. Hence the double necessity for an apron—to keep dirt from the exposed working parts and keep oil from splashing on the tires.

MORE ABOUT PARALLEL WHEELS

Inexperienced drivers do not readily comprehend the extent of the tire expense which results from driving a vehicle whose wheels are not parallel to the general direction of the wagon. The friction is enormously increased, as the wheels are presenting the bases of cones instead of the bases of cylinders to the roadway, with consequent loss of speed and great wear on the tires. The majority of wagon builders are well acquainted with this fault, and take great care to avoid it. Still it often happens that a novice collides with the curb with more or less force, and, although it may not be apparent, the wheels are no longer parallel. It is well worth while to lay a straight edge at the side of the hind wheel, which will soon show whether the fore wheel is in its proper position in relation thereto.

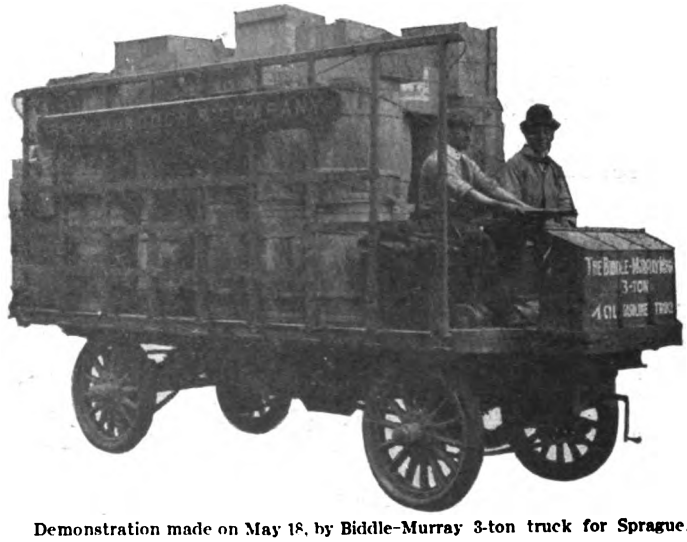
SYMPTOMS OF FAULTY LUBRICATION

When a sight feet glass begins to fill up with oil, it may safely be taken as an indication that the duct to which it leads has become clogged and that the bearing is getting none of the lubricant. The mere fact that the sight feet glass is delivering its supply without question is, however, no absolute proof that all is as it should be, for the duct or pipe may have broken off, or one of the connections may have started a leak. It is therefore essential that a thorough examination of the oil feeds be made from time to time at the point of delivery.

IMPORTANCE OF CLEAN CHAINS

It is difficult to realize how great an effect upon the performance of a chain drive the presence or absence of rust may have, but when it is remembered that each link comprises a bearing and its journal, and that twice during each complete cycle of travel this joint with its closely fitted bearing must be bent into conformation with the sprocket and then straightened again, some idea may be had of the resistance added by even a small amount of rust and dirt in these little link bearings.

A project is on foot to connect the principal towns of Roane county, Tenn., by means of motor bus lines. The first of these lines will likely be operated between Kingston, Rockwood, Cardiff, Emory Gap and Harriman.



Demonstration made on May 18, by Biddle-Murray 3-ton truck for Sprague, Warner & Co., Chicago:

	LOAD	STOPS	DISTANCE	ELAPSED TIME
1st trip	6300	14	23 miles	4 hrs. 10 min.
2nd trip	4800	9	14 miles	2 hrs. 3 min.

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Information to Buyers

NEW CARDAN JOINT

THE Hartford Automobile Parts Co., Hartford, Conn., has brought out a type of universal joint for shaft drive cars which embodies a new application of an old and well tried principle. As will be perceived from the illustrations, the joint has no center block or spider, but consists of double arm driving yokes with spherical or ball ends, these ends fitting into sockets in an annular ring. This socket ring is made in halves and each pair of half sockets is slotted sufficiently to admit the neck of the balls, and allow an angular motion of the yokes of fifteen degrees either side of the normal. It requires four half rings identical in construction for each complete joint, either pair of halves being of necessity assembled with the breaks at right angles, so that when bolted together the four parts become a rigid ring. As a reinforcement, and to hold in place the pressed steel enclosing casings, an outside steel flanged ring is fitted. The casing is all metal and consists of two semi-cylindrical covers, closing over caps fitted to the driving hubs, the joint being made grease tight by means of felt packing.

Many advantages are claimed for the application of a pair of ball and socket joints to obtain universal drive. Besides the well established fact that a spherical bearing will work under a greater pressure per unit of area with less friction and less danger of cutting than a cylindrical bearing, attention is called to the impossibility of the friction loss in this form of joint increasing with the load. Many types of joints of light construction, the bearings of which are in perfect static alignment, show an appreciable loss of power when subjected to load. In the "Hartford" joint no such cramping effect is possible, it being evident that free motion would not be interfered with, even if shock or overload were sufficient to bend the driving arms somewhat. It is also pointed out that the construction gives great strength by carrying the weakest point of the system far out from the center, thus decreasing the breaking strain.

All parts of the joints are of steel and are interchangeably machined. The driving yokes are forged from carbon or nickel steel according to specification, the ball ends being case-hardened. The socket rings are drop forged from tool steel and spring tempered, the combination of metals resulting in a bearing of very high quality and one which experience has shown will not cut even when lubrication is insufficient. Ample provision is made, however, for efficient lubrication. An annular groove is cut in each spherical socket with large channels connecting to the grease chambers. The rapid revolution of the joint forces the grease directly on to the friction surfaces of the balls.

The company has completed arrangements to produce in quantities both single joints and complete driving sets, including dust proof slip joint and driving shaft, for the 1907 manufacturing season.

TO DELIVER DRUGS.—The Yahr and Lange Drug Company of Milwaukee, has purchased a 20-hp. delivery wagon from the Meiselbach Motor Company. The machine has a carrying capacity of 1,000 pounds. The Gerretson Silk Company of Milwaukee, will also use one of the Meisebach wagons.

IMPORTANT CONVERTS. — The Knox Motor Truck Co., Springfield, Mass., recently sold Atlas trucks to W. & J. Sloane and J. R. Horner, New York City; Hammond & Sloane, Brooklyn; P. Duff & Co., Pittsburg, Pa.; John P. Squire & Co., Boston; W. M. Applegate, Bethlehem, Pa.; Kuntz, Johnson & Co., lumber dealers, Dayton, Ohio; Cheney Bros., South Manchester, Conn., and three to the Auto Vehicle Co., of Los Angeles, Cal.

FUEL ECONOMY.—In the course of the recent fuel economy contest the 18-passenger bus manufactured by the Mack Bros. Co., of Allentown, Pa., made a notable performance. It carried 19 passengers and traveled 17.13 miles on the allotted two gallons of gasoline. The gross weight of the car and passengers was 10,125 lbs. The vehicle was given fifth place. The weight of the passengers is estimated to have been 2630 pounds. By carrying these passengers 17.13 miles, the car can be credited with 45,051.9 pound miles on the two gallons of gasoline, costing about 30 cents. This is less than two cents a passenger for the distance, and less than one-tenth of a cent per mile per passenger.

Dubos, Simo & Co., of Havana, Cuba, have purchased of J. Edsall, Cincinnati agent of the Logan Construction Company, six light delivery wagons. This company owns several thousand acres of land in Cuba, on which light fruits are raised. The wagons will be used to carry the fruits and vegetables from the interior to the wharves for shipping.

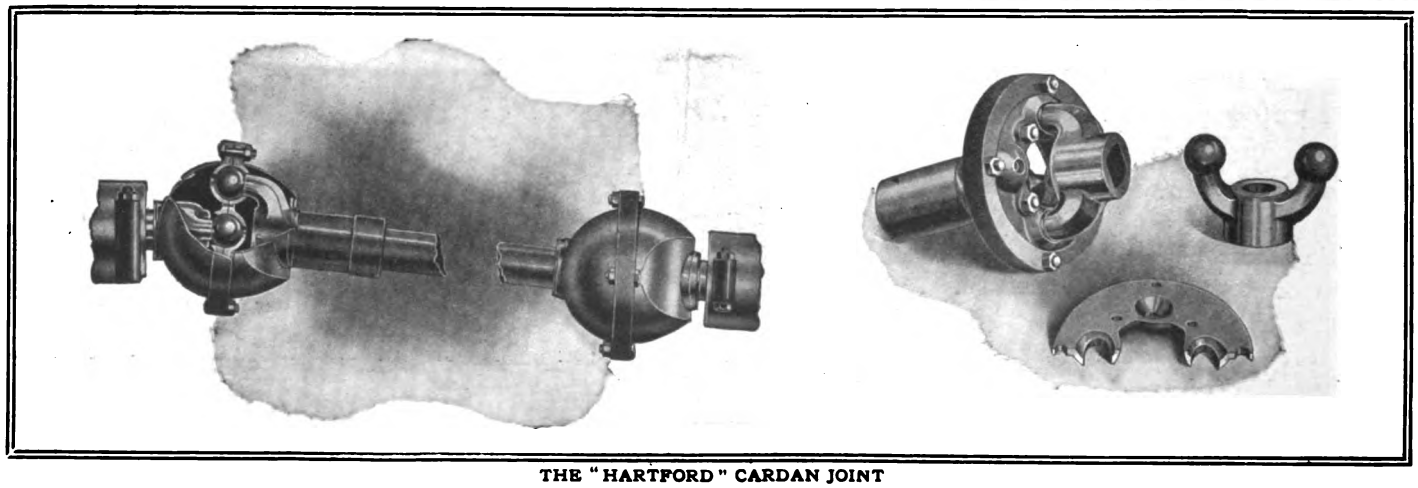
CLIMAX DELIVERY WAGON.—The manufacturers of this wagon, Hinde & Dauch, Sandusky, Ohio, have for several years seen the necessity for building a light commercial car, one that would be light in weight, durable, and simple to operate—at a price that would be within the reach of all. With this in mind they proceeded to secure men to design such a car, men who had years of automobile experience and knew the requirements of a light commercial car. The result is a car has been produced that is a success in every way. It accomplishes all it was intended for. This car weighs but 1,400 pounds and has ample power and strength to carry 1,000 pounds with ease at a speed varying from four to twelve miles per hour. Quite a number of these cars are in successful operation in different parts of the country, every one of which is giving excellent satisfaction.

SATISFACTORY TEST—Recently the Hedgland axle was tested by the technical committee of the Automobile Club of Great Britain. The test was made with a car weighing, loaded, 4,399 pounds, which traveled 1,000 miles in six days on dry and slippery roads at variable speeds. The committee reported that its experiments with the axle showed an appreciable absence of any tendency to slip or skid.

SIGHT SEEING CARS—The Rapid Motor Vehicle Co., of Pontiac, Mich., will furnish a number of 20-passenger sight-seeing motor cars to the American Sight-Seeing Coach Co. This organization controls sight-seeing enterprises in New York, Boston, Philadelphia, Washington, St. Paul Kansas City, Denver, Salt Lake City and other principal cities.

"DIAMOND" CHAINS
Outnumber, Outwear and are Stronger than Others
WRITE FOR CATALOGUE
DIAMOND CHAIN & MFG. COMPANY
INDIANAPOLIS, IND.

Pressed Steel Truck Frames
The
PARISH & BINGHAM CO.
CLEVELAND, OHIO



THE "HARTFORD" CARDAN JOINT

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WALTER WARDROP, EDITOR AND PUBLISHER

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Truck With Gas-Pipe Frame

E. J. Pennington Again Startles the World With a Description of a New Vehicle He is Building

AT regularly recurring intervals E. J. Pennington issues from some quiet retreat, makes a great stir over some commercial bubble he has blown, indolently watches while it is being pricked, and then retires to obscurity again till the mirth of the nation has subsided. In this performance he is as punctual as the changes of the moon. His vagrant mind will not permit him to work for a longer time than is required to sign stock certificates and inspire glittering articles concerning his projects for daily newspaper consumption. Few of his schemes ever come to fruition.

Reviewing the antecedent history of the singularly audacious promoter, it is difficult to believe that the report, coming from Lansing, Mich., has any more substantial foundation than previous ventures associated with his erring genius. He is said to be preparing to build a marvelous motor truck. Evidently he is unknown in Lansing, for he is grandly described in the public prints as hailing from New York after an absence of 11 years in England, where automobile construction of one kind or another has deeply engaged his attention.

Pennington's experience abroad is not of such a nature as to bear too close scrutiny. Many years ago, while the automobile industry was as yet in a state of chrysalis, he acquired some sort of title to a gasoline engine which he sold upon highly advantageous terms to a group of nervy financiers who forthwith proceeded to sell rights under the patents in every quarter of the world. If there is a trace of manufacture resulting from this impudent flotation it has not been encountered in commercial life. Its effect, however, was to establish Pennington as a man of considerable talent, and thereby give him opportunity to point to a paper record of successful achievement. Since that time he has been wandering about this country, now in one city and now in another, attempting to launch enterprises bearing remotely or directly upon the problem of industrial motor traction in city and rural work. By everybody connected with the automobile industry he is regarded as a slippery operator who has long since shot his bolt.

In Lansing, however, it is believed that he will build a great many 4-ton trucks fitted with 100 hp., two-cylinder engines and frames constructed of 4-inch gas pipe. In order to give a touch of artistic verisimilitude to the story, he lets it be known that the fly wheel of the engine will weigh 400 lbs., while the gasoline tank, with a capacity of 20 gallons, is to be located under the driver's seat. The rating of the engine is characteristic of Pennington. Fifty horse power for a 4-ton truck would be more than ample, but Pennington, with the large bounty for which he is famed, flings in an extra fifty for good measure. The truck is to sell at $4,000.

Acting under the influence of the magnetic spell of this master non-producer, a daily newspaper reporter hysterically announces that wooden wheels will be one of the valuable features of the truck's construction. Obviously Pennington's originality has become frayed at the edges. He no longer takes the trouble to invent. Most people give him credit for originality. It is doubtful, however, if in the whole course of his unquiet career he has ever developed any mechanism which would command attention among serious people.

This enterprise, however, has much of the commercial dash of former vain and ineffectual campaigns. The flattering hope is held out that if the truck is successful Lansing as a manufacturing center will flourish like a

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green bay tree, and a large factory will at once be erected.

Bait of this kind is always swallowed by gudgeon.

Gas pipe being cheap, we may look for the early construction of the new truck's frame. Wood is also a low priced and plenteous commodity, and therefore we are reasonably certain that the wheels of the vehicle truck will be brought into being. A 400 lb. fly wheel can be cheaply cast. These and working drawings of the engine, axles, transmission and other parts should convince skeptics that the Pennington truck will add to the renown of its illustrious author and and make investors with him rich beyond the dreams of avarice.

Comparison of Costs

Figures Which Show the Inadequacy of Horses in Work for Which Motor Vehicles are Employed

WHILE there is no lack of carefully compiled figures to prove the economy of gasoline wagons over horse-drawn vehicles in any given service, the information they afford cannot be made available for general purposes of comparison. Most of the attempts at broad work have failed to command attention because many important items of accounting were overlooked, either intentionally for the purpose of advantaging the cause of the power wagon, or unintentionally through ignorance of horse stable charges.

Recently, however, a document has been put in circulation which demonstrates that for a given mileage—which completely destroys the usefulness of four horse-drawn vehicles—the advantages of the light delivery power wagon are overwhelming. It assumes that 40,000 vehicle miles represents the usefulness of a light motor truck. This, however, may be considerably increased if proper care is given to the vehicle. It is further assumed that the average useful life of a horse wagon, with load not exceeding one ton, is 10,000 miles.

Granting that a horse-drawn vehicle of the class mentioned will cover not more than 4,000 miles per year, and that a light motor truck will cover 10,000 miles, the horse wagon would require ten years to traverse 40,000 miles which the motor truck will cover in four years. If both wagons are operated 300 working days in the year, and the driver of the horse vehicle is paid $2.50 per day, and the driver of the power wagon $3.00 a day, at the end of 4 years enough money will have been saved in wages alone by the power wagon to buy two more such vehicles, the saving in this particular being fully 50 per cent.

The figures submitted below are based upon information furnished by large users of horse drawn vehicles:

COST OF LIGHT HORSE WAGON SERVICE

Horses and wagons for 40,000 miles, 4 outfits at $500 each	$ 2,000.00
Driver at $2.50 per day, 3,000 days	7,500.00
Horse stabling and maintenance, 3,650 days at 75 cents per day	2,737.50
Wagon repairs and painting, $50 per year for 4 years	200.00
Harness repairs at $10 per year for 4 years	40.00
Shoeing, $2.50 each per month for 4 years	120.00
Total	$12,597.50

COST OF LIGHT POWER WAGON SERVICE

Light Motor Truck, serviceable for 40,000 miles	$1,500.00
Driver's salary, 1,200 days at $3 per day	3,600.00
Gasoline, 68 test, 10 miles to the gallon at 12 cents per gallon	480.00
Batteries	60.00
Three tire renewals in 4 years at $200 a set	600.00
Overhauling wagons once each year	300.00
Lubricant, $3 per month for 4 years	144.00
Stabling, $10 per month for 4 years	480.00
Total	$7,164.00

COMPARISON OF COSTS

Cost of operating horse-drawn vehicles	$12,597.50
Cost of operating motor truck	7,164.00
Money saved by use of motor truck	$ 5,433.50

SUBWAY PATHS FOR MOTOR WAGONS

SUBWAYS for motor trucking are suggested by an eminent engineer as means of relief for New York's street traffic congestion. Instead of making a rapid-transsit subway twenty feet underground he would have one made at least double that depth, providing for a freighting line beneath the present roadbed. To him the coming enlargement of this subway seems a necessity of the near future and he would, in this enlargement, provide for express, freighting and trucking, as well as for greater passenger traffic. He would have shops and stores load for delivery in sub-cellars directly on to motor wagons. These vehicles should have first rights on a plain roadway on either side of the tunnel railway. This would leave the surface streets to pedestrians and light vehicles.

MUNICIPAL HORSES TO BE SOLD

SIX horses and two wagons, employed in police duty in Rochester, N. Y., are to be sold at once, two electric wagons having been purchased to perform the service they have been rendering. In a short time the horse-drawn municipal ambulance wagons will also be superseded by motor vehicles.

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Value of Trailers

Prophecy Made That Motor Tractors and Trailers Will be Extensively Used in Heavy City Service

WILL the individual heavy motor truck be superseded in city service by the motor tractor and trailer? Mr. Henry Ford announces that the change is bound to occur, supporting his views of the matter by the following vigorous and picturesque remarks:

"What would we think of a railroad company which equipped every freight car with its own motive power? Or of a great lakes freighting company that incorporated a powerful engine in every barge? As well resort to these expensive methods as try to build motor trucks which shall at the same time carry the load and house the power plant. The obvious and the only practical solution of this problem is in the motor tractor. The passage of the free alcohol bill makes the field of the motor tractor practically limitless. Its uses are confined not alone to the work of the city, but its necessity is still more seriously felt in rural districts. Farming, which should be the ideal occupation for man, is an existence fraught with drudgery owing to the lack of proper machinery to perform the work. All the work of the farm, from plowing the ground, rolling it, hauling the drill, then the harvesting machines and finally conveying the produce to market or to the nearest railroad shipping point should, and in the very near future surely will, be performed by a motor tractor of, say, 40-horsepower geared down to about six miles per hour.

"This same vehicle with slight modifications will be the future motive power for trucking in the cities. One car or a train of them can be hitched to the tractor as conditions may demand and the problems of spring suspension and tire consumption will be confined to the tractor alone. When the load is a known and a constant quantity these problems are easy of solution, but when, in addition to the normal weight of the vehicle itself, you must figure on its maximum and all intermediate loads and provide for them, it resolves itself into a well nigh impossible conundrum.

"With the motor tractor furnishing the traction, the wheels of the freight cars may be shod cheaply with wide steel tires. Vibration will cut no figure so far as they are concerned and each wagon may be made to carry its load of whatever material without in any way affecting the design or the construction of the power plant. The tractor will perform twice the work that would be possible for the motor wagon that was at the same time locomotive and flat car. While its train is being loaded or unloaded, the tractor may be performing other duty by hauling another train."

Doubtless Mr. Ford would desire that the foregoing opinions should be regarded as having strict application to power wagons of the heavier class. If this concession is made few city users of heavy trucks will deny the general correctness of his conclusions, although it is obvious that only limited use can be made of tractors and trailers where terminal and street conditions are poorly suited to their employment.

Abroad, where motor lorries and trailers are extensively employed, it has been conclusively shown that the vehicles perform to best advantage in interurban service, market gardeners, fruit growers, large growers of agricultural products, breweries and other manufacturing establishments which are distant but a day's journey by motor wagon from big centers of commerce being among the most liberal patrons of this form of transportation.

It is an error to suppose that American motor wagon manufacturers are not keenly alive to the advantages of the trailer. In Milwaukee an exhibition of its usefulness was recently given for the purpose of demonstrating the ease and economy with which enormous loads could be hauled through streets which are open to such extraordinary traffic. A power wagon with four trailers on this occasion transported twelve tons of sugar, seven tons being loaded on the motor vehicle and five on the trailers. This is not by any means the first time large loads have been transported by power wagons in this country, but it undoubtedly is the first attempt to indicate how great are the possibilities of modified motor vehicle traction.

Some instructive thoughts bearing upon this subject will be found in another part of this issue in an article dealing with the relation of solid roads to heavy motor vehicle traffic.

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Tardy Recognition

Newspapers Recognize Force of Movement Making for Evolution in Minor Transportation

SOMEHOW or other as we take note of the competition among powerful daily newspapers and periodicals to be early in giving public recognition to the usefulness of the power wagon we are reminded of Dr. Samuel Johnson's scornful reply to Lord Chesterfield when, after years of indescribably hard labor, during which the great lexicographer was treated with the grossest contempt, his lordship humbly sued for the bare privilege of becoming his patron.

"When," wrote the Great Cham of Literature, "upon some slight encouragement I first visited your lordship, I was overpowered, like the rest of mankind, by the enchantment of your address, and could not forbear to wish that I might claim that regard for which I saw the world contending. But I found my attendance so little encouraged that neither pride nor modesty would suffer me to encourage it. Seven years, my lord, have now passed since I waited in your rooms or was repulsed from your door, during which time I have been pushing on my work through difficulties, of which it is useless to complain, and have brought it at last to the verge of publication without one act of assistance, one word of encouragement, or one smile of favor. Such treatment I did not expect, for I never had a patron before. The shepherd in Virgil grew at last acquainted with Love and found him a native of the rocks. Is not a patron, my lord, one who looks with unconcern on a man struggling for life in the water, and when he has reached ground encumbers him with help? The notice which you have been pleased to take of my labor had it been early had been kind; but it has been delayed till I am indifferent and cannot enjoy it, till I am solitary and cannot impart it, till I am known and do not want it. I hope it is no very cynical asperity not to confess obligations where no benefit has been received, or to be unwilling that the public should consider me as owing that to a patron which Providence has enabled me to do for myself. Having carried on my work thus far with so little obligation to any favorer of learning I shall not be disappointed though I shall conclude it, if less be possible, with less."

A number of influential papers seem to have simultaneously discovered the extraordinary advantages of the power wagon and with customary pushfulness are grooming themselves for the agreeable duty of patronizing it. If the help they extend is modified by judgment and prompted by sincerity of motive there is every reason to expect that the evolution in minor transportation which the motor vehicle forebodes will be greatly accelerated. Comparatively little good, however, is to be accomplished by the printing of articles which, like the one we partly reproduce from *Collier's,* practically ignores the question of economy while criticizing faults of construction that are too rare to be regarded as typical. Perhaps as the author warms to his work the public will be enlightened concerning the causes which conspire to give the power wagon vogue wherever its money and labor saving qualities are perceived.

The practical power wagon, or motor-driven utility vehicle, is one of the most conspicuous facts of present-day commerce and mechanics. Its appearance is an event as momentous as the inauguration of the railroad. Its field of usefulness must inrease constantly, as civilized activities expand.

Formerly some manufacturers unwisely attempted to build utility vehicles on the same lines as touring cars. It is hardly surprising, then, that with careless drivers and constant overloading and overspeeding they failed in service and cast discredit upon the power wagon in general. We can understand, therefore, why some people still exaggerate the difficulties of power wagon design, and prefer to wait for the "perfect motor," which will probably eventuate sometime during the millennium, when perfection may be reasonably expected.

While wagons built for pleasure doubtless have sufficient strength to carry reasonable loads, they can not be expected to "stand up" to long hard service. Their light springs will give; their high-speed engines will overheat, and their pneumatic tires will puncture and wear out. Briefly expressed, the power wagon must combine strength in frame, springs, and gearing. It must be driven by an engine that will not "lie down" under any loads. It must have better tractive qualities than any pleasure car; but it cannot have pneumatic tires. That all these elements are ready at hand for the designer is a simple matter of experience.

The editor of *Collier's* sent a representative to visit the automobile manufacturers and experts in several American cities, and report on the present state of the power wagon. Most interesting among the things unearthed by this representative was the information that several prominent builders of pleasure vehicles have equipped the chassis of old touring cars with platform bodies, and use them as general utility wagons. One authority reported such a "dinky cart" in constant use for over two years, carrying all kinds of loads up to two tons, traveling over all kinds of roads, making good speed, and costing about $120 monthly, including tire repairs and driver's wages. In point of cost, and work accomplished, it had actually outclassed by three to one the horse teams previously required for the same service.

The performance of such vehicles in competent hands is an indication of what might be expected of specially designed power wagons in general service. However, the general situation was well expressed by Henry Ford, the well-known automobile designer, in the following words:

"To hitch a blooded light-roadster to a laundry wagon—a track horse to a dray—would, to my mind, constitute a no more wasteful and ridiculous excess than putting the delivery body on a touring car chassis and using it for a business vehicle. It will answer the purpose, doubtless—but so also might a hod-carrier perform his duties in a dress suit, instead of overalls.

"The pleasure car, designed—evolved is a better word—to meet conditions of comfort and speed, and reduced to the last degree of lightness, compatible with strength sufficient to withstand indifferent country roads, is a finer piece of mechanism throughout than is demanded by the less exacting conditions to which the commercial vehicle is subject—heavy loads, but moderate speeds, and with well-paved city streets for the most part to be traveled."

Mechanically speaking, there are no insuperable difficulties involved in the design of a serviceable power wagon. A heavy-service wagon differs from one designed for light and medium weights, just as a trucking cart differs from a runabout. The mechanism adequate for the one, therefore, is not required for the other. They must be separately designed.

The real reasons why the appearance of the power wagon

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has been delayed are quite other than mechanical. In the first place, the leading and most experienced manufacturers have found the business of building pleasure vehicles so profitable, and so rapidly increasing, that other designs have been neglected. Again, the prospective purchaser, while cheerfully disbursing immense sums for a pleasure automobile, seems reluctant to pay even a fair amount for a utility vehicle. "If," he seems to argue, "one power wagon can do the work of three horse teams in its own class, it should cost no more than one team." This is discouraging to the manufacturer, who cannot afford to sell below cost.

Most conspicuous, however, among obstacles in the way of the power wagon is the great American ignoramus. The power wagon must not only embody the latest and best mechanical elements for the performance of its work, but it must be completely *fool-proof*. More "failures" of the power wagon are due to incompetent and untrained drivers than to all the defects of design and faults of construction ever discovered. This should serve as a warning to the devotees of false economy, who are ever the first and loudest in finding fault. The irresponsible driver will wantonly overload and overspeed his wagon and habitually neglect his engine. Perhaps the millennial "perfect motor" may withstand his abuse; present constructions can not.

The question, then, is not: "Will the power wagon supplant the horse?" Rather it is: "How long will the horse be with us?" In virtually every branch of human activity the horse is already a disappearing factor. The railroad locomotive and the electric trolley car have long since eliminated him as an agent in long-distance transportation. The electric truck is rapidly effacing his significance for local drafting. The light and medium weight gasoline wagons are already competing in the field of retail delivery and parcel express. Even the noble fire horse will soon be listening for his last alarm.

In the great Western country, where horse-stealing was once a hanging crime, the steam tractors are dragging the gang-plows over the virgin prairies, and supplying power for the thrashers, binders, and separators. Even in warfare the motor is in evidence, dragging long trains of baggage wagons for the commissary, or, encased in full armor, like a knight of old, carrying a machine gun whose savage bark stifles the tuneful churning of the engine.

The power wagon can move faster, can carry a heavier load, and can carry it farther and longer than any horse yet created or evolved. It never grows weary. It is ever ready. It requires no large stores of food. It is content with any shelter. It may be repaired after any accident, short of total demolition. It does not die.

The power wagon resembles the horse only in its demand for unforgetting care, and for a skillful hand to guide it. It fills less room in a crowded street. It can turn in its own length. It can move backward, as well as forward. It contracts no diseases and occasions none. It necessitates no large and unsanitary stables for its shelter. It leaves the streets clean. It is less dangerous to pedestrians.

The power wagon is, of all vehicles yet evolved, the cleanest, quickest, cheapest, most efficient. It is the only highway vehicle that meets the demands of this age of great things done quickly. It will rank among the necessities in the no distant future.

ALCOHOL MOTOR TRACTORS

HENRY Ford's vigorous opinions concerning the utility and economy of motor tractors drawing trailers are in no wise impaired by the report that he is to head a large company now being organized to make these vehicles. It is said that alcohol or some other cheap liquid fuel will be used to obtain power. One of the Detroit papers recently commented as follows on the project:

"It is well known in automobile circles that Mr. Ford has long been experimenting with motor tractors, and he has frequently stated that in this form would ultimately be developed the practical commercial vehicle. Ford has also made exhaustive experiments with alcohol as fuel for internal combustion motors and has been very secretive about the positive results of these experiments. The report is that Ford will be the scientific head of the new enterprise—or, rather, if he will consent to guide its destinies the deal will go through and Detroit will be the point chosen for the erection of the plant. The deal contemplates an investment running into millions."

Mr. Ford declines to discuss the subject.

OPPOSED TO MOTOR POLICE WAGONS

SOME neither can for wits nor critics pass, as heavy mules are neither horse nor ass. This was one Pope's stinging retorts to the taunts of his ignorant critics. It is a convenient reply to the chatter of the president of Cincinnati's public safety board about the danger and unreliability of municipal motor wagons.

It appears that the mayor, the chief of police and three of the four members of the board favor the purchase of motor patrol wagons for the police department. The president opposes the appropriation, saying:

"You are talking about buying motor wagons. Well, if any are bought, I favor the purchase of four, because three of them will be in the shop all the time. Why, there is murder every day by automobiles. They are dangerous to handle, dangerous to ride in, and dangerous to pedestrians."

Let us be charitable and hope that this worthy displays better judgment in passing upon other matters within the jurisdiction of his office.

MOTOR BUS EARNINGS

STUDENTS of the motor omnibus movement are looking forward with no small degree of interest to the first balance-sheets of the various London companies, as future prospects will be largely affected by the rates of depreciation that will prove to have been adopted in drawing up these statements. At least one company has adopted the cautious policy of writing off no less than 33 per cent per annum on the first cost of its road vehicles. While this heavy charge would no doubt be excessive in some cases, it is better to err in the direction of safety than to render accounts temporarily attractive by insufficient provision under this vital head.

BUS LINES CONSOLIDATED

BY the consolidation of the Dewhurst Interurban Automobile Company with the Interurban Motor Traction Company, both located in Lexington, Ky., a new company has been organized with a capital of $50,000. It will operate passenger and freight motor cars from Lexington to Nicholasville, North Middletown and Richmond.

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Motor Fire Vehicles

Many European Cities Are Showing Big Economies by Discarding Horse Service

HORSE drawn fire fighting apparatus is conspicuous among the things which discredit our civilization. But with the example Vienna, Paris, Liverpool, Hanover and other actively progressive cities are setting the hour cannot be long delayed when the electric storage battery and the gasoline engine will give "man's best friend" total relief from his showy but inefficient labors in this field. Observe that London, New York, Chicago and other large cities are not on this honor roll. The most populous cities in the world still present the extraordinary spectacle of all their fire apparatus being toted by Dobbin. From such extreme conservatism it is pleasant and stimulating to turn to Europe and witness what the automobile movement has there accomplished for the betterment of this important branch of public service.

Sometime ago Vienna decided to re-equip its professional and auxiliary suburban volunteer fire brigades with electrically propelled apparatus. And it is worthy of note that the extent of its first order may be held to imply the immense economies and advantages which are to be derived from a total substitution of draft animals by automobile power. Fifty-three motor chemical engines, ladder wagons, hose carts and other vehicles have been purchased, and when those have been put in service and more money is available the steam fire engines will be crowded out. The present step, therefore, is one of the most important in the annals of the world's fire service.

It is highly interesting to observe that the Vienna fire brigade budget shows that there will be a saving of $15,830 per annum, and that as the new appliances involve an outlay of $177,080 the whole of the new and more efficient appliances will practically be paid for out of economies in something like eleven years. That motor appliances, when worked in numbers, mean a considerable economy was proved by experiment at Vienna prior to arriving at this decision, and it has been equally proved in Hanover, where experiments with a number of motor fire appliances have been carried out for the past three years. The same experience has been obtained in Liverpool.

Time is the great element of success in fire fighting, and there is clearly an advantage in using a motor vehicle which can travel twenty-five miles an hour, as compared with a horse team which could not exceed fifteen miles an hour, and probably could not maintain that speed for any length of time. Of course, it will be pointed out, in the tortuous streets of some cities high speed is not possible. But the fact remains that an ordinary motor car can travel through any part of a city at a much better average speed than the fastest horse-drawn fire engine with a way specially cleared for it. There is something absurd in the spectacle of a city fire brigade going to work with its horse teams. The absurdity of the display is all the more marked when the speed is compared with that of the electric fire vehicles in Paris, the thirty-mile-an-hour engines used in Liverpool, or the thirty-five-mile-an-hour first-aid engine which the Leicester corporation in England has just acquired.

In Paris the fire escapes are carried on electric vehicles. In fact the complete traveling equipment of one Paris station is provided with electric motors.

It is nearly four years since the Hanover fire brigade was experimentally equipped with automobile apparatus. Gradually additions were made, until now horses are no longer employed. At first two electric vehicles were installed—a chemical engine costing $3,825 and a hydrant carriage costing $1,750. Their performances were carefully noted. The cost of upkeep for three years was as follows:

MAINTENANCE OF TWO ELECTROMOBILES

	1902-3	1903-4	1904-5
Repairs on motors	$ 3.80	$ 4.34	$ 87.10
Repairs on control	5.04	.....	.....
Repairs on wheels and tires	43.42	49.92	19.68
Repairs on chassis	.....	9.48	.....
Accumulator charges, regular work	164.32	147.72	124.82
Accumulator charges for trials	39.04	18.12	20.12
Repairs on accumulators, acids, etc.	22.12	3.78	176.24
Oils and greases	5.40	6.72	5.16
	$283.14	$240.08	$433.12
			240.08
			283.14
Total			$956.34

The reason why repairs for the third year were relatively so high is as follows: (1) several armatures of the motors were removed, having become defective through water; (2) positive plates in both electromobiles were replaced; (3) the automobile chemical engine received damages through an accident which occurred during an experimental excursion, the repair for which amounted to $257.52. This accident was the only serious affair in the three years. At the present time all engines and appliances are in perfect condition, and giving satisfaction in every possible way.

This information is not only interesting in its bearing upon fire apparatus, but is of importance on account of the manner in which the subject has been approached and the facts collated in connection with business automobiles generally. It certainly looks as though the American boast of preeminence in fire-fighting and methods could be no longer substantiated. While the majority of fire departments are giving final touches to an almost perfect antiquated system, Paris, Vienna, Liverpool and Hanover have successfully struck out in the new path.

While our fire departments have under consideration

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the momentous question of whether the gilt stripe on the wheel should be double or single, or be 1-4 inch or 3-16 inch in width, their much despised European brothers have temporarily forgot the striping in the interesting operation of breaking into up-to-date methods. Some hope is to be derived from the recognition many progressive cities are giving to the advantages of the automobile for emergency work, for example, in their use for the transportation of fire chiefs and insurance inspectors.

One of the drawbacks in this country, in fire apparatus as in other matters among those not strictly initiated, is that novelty commands the first attention, and it is safe to say that dozens of fire chiefs today are assiduously wasting their time and gray matter in the examination of novel devices to accomplish the useless, while turning their backs upon the orthodox and well tried automobile methods. There is novelty enough in the application of these well tried methods of fire apparatus without introducing original and unnecessary experimental features.

The budget of the Vienna fire brigade is strongly confirmatory of the great commercial advantage to be derived by a complete substitution of automobiles for draft animal service. We have pretty good evidence that the earliest experiments with the Vienna automobile fire apparatus were disappointing, particularly in degree of saving attained, but the estimated and now demonstrated saving in the entire service was so overwhelming as to allow an immense margin of safety for unforeseen calamities.

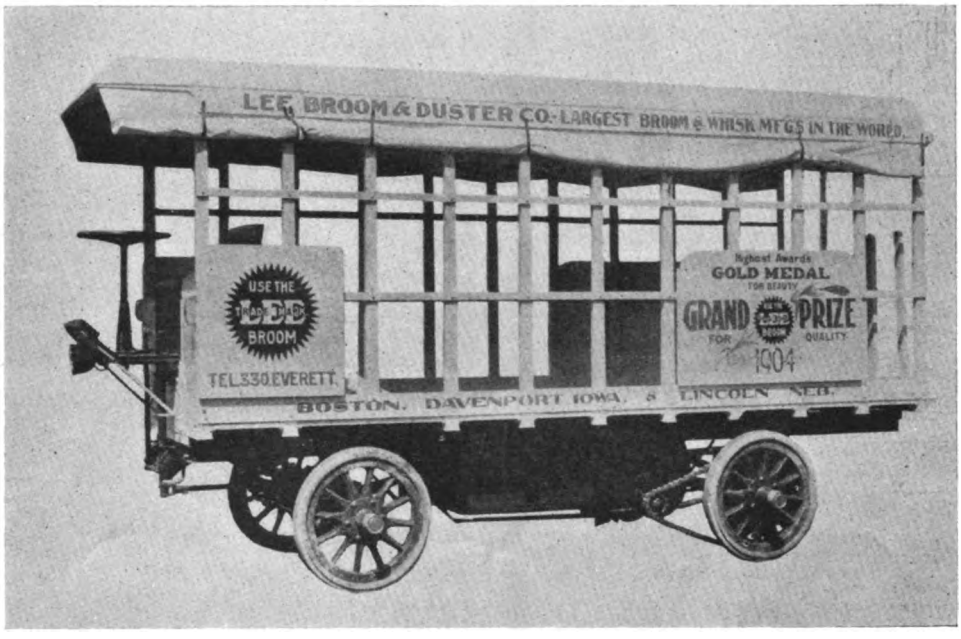
The experience of the Hanover authorities confirms the recognized inferiority of European electric automobile motors, in spite of which such a great success appears to have been attained. It is hardly conceivable that the best makes of American electric automobile motors would suffer from water even under the most strenuous circumstances.

NOVEL MOTOR FIRE ENGINES

A MOTOR propelled chemical fire engine in Rheims, France, possesses some unusually interesting features. The vehicle is fitted with a 14 hp. engine and has a speed of 12 miles an hour. The fire-extinguishing plant consists of two hermetically sealed tanks, each of one hundred gallons capacity, a series of flasks containing liquid carbonic acid gas, and two reels, each carrying forty-three yards of hose. When the machine is put into operation the liquid gas is permitted to flow into two special expanding tanks, where it gasifies and mingles with the water at a pressure sufficient to force all the water out of the tanks through the hose and nozzles to a height of 115 ft. By the operation of the expanders, one to each tank, the expelling gas pressure is always constant. The extinguishing power of the water is, of course, vastly aided by the presence of the carbonic acid gas. When the tanks cannot be refilled by pressure from the mains, a pump driven by the motor performs that duty.

LEGISLATORS ENDORSE MOTOR AMBULANCES

UNLESS the upper house of parliament undoes the work of the lower house London will shortly be supplied with motor ambulances. A bill providing for the purchase of ten vehicles was recently passed by the commons.



The Latest Pope-Waverly Product

WHILE the two-ton truck shown above necessarily has much in common with all electric industrial vehicles it possesses a few features which peculiarly adapt it to the service of the Boston branch of the Lee Broom & Duster Company. The carrying capacity, for example, is unusually large, the inside measurements being sixteen feet in length, six feet wide, and seven feet high. The vehicle is fitted with two double reduction motors, a double side chain drive; battery equipment consists of 42 cells, and both hub and counter shaft brakes are provided. The steering gear is of the pinion and sector type.

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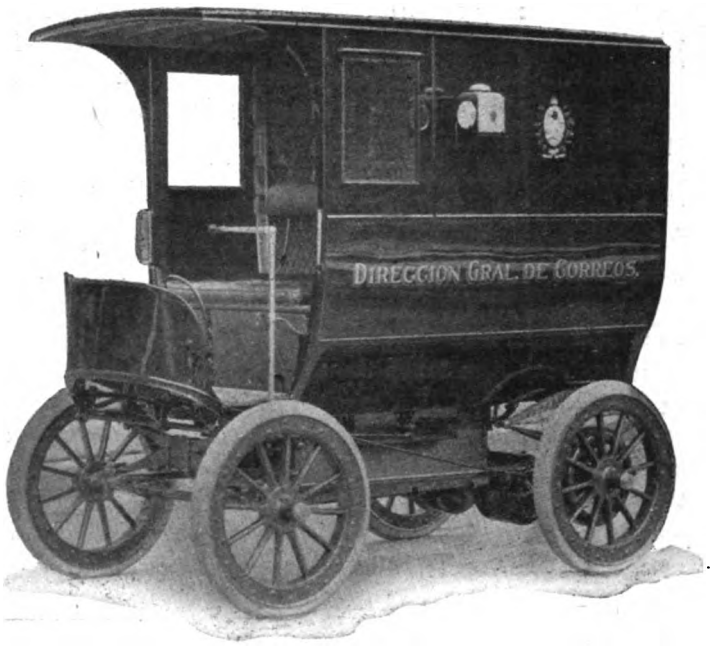
WHAT SKILLED HELP CAN ACCOMPLISH

SEVENTEEN electric vehicles are employed in the service of the Hartford Electric Light Company, of Hartford, Conn., which, besides illuminant, furnishes heat and power for public consumption.

A two ton truck, with a speed of eight miles an hour—originally designed for emergency fire wagon work, but altered to suit present usage—is used by linemen of the erection gang. For a time this wagon was fitted with steel tires. It has been in service five years, and is still very efficient.

Another two-ton truck, averaging 35 miles per day, is used for hauling supplies from the railroad stations to the several power plants of the company, which, on account of their isolation, necessitates considerable traveling for the vehicle. It has been in service four years. Its average speed is about ten miles per hour.

The Meter and Lamp Wagon.

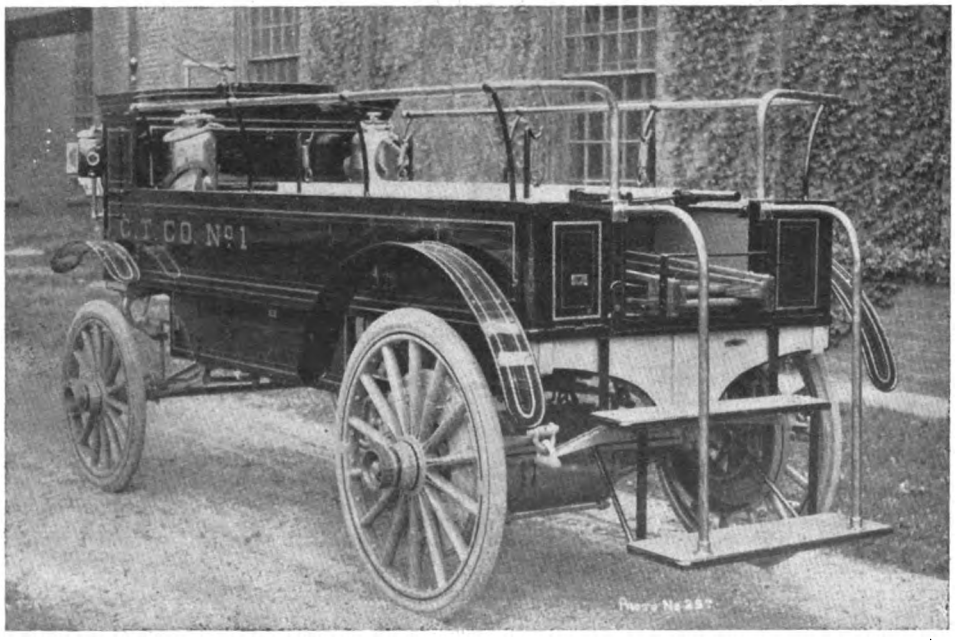


In Commission For Five Years.

A ton-and-a-half truck, with a speed of ten miles an hour, is used by erection men as a supply wagon, and besides necessary paraphernalia usually carries five or six of the erection gang.

Two light delivery wagons, formerly used at the Buffalo Exposition as mail wagons, are employed by the company for the meter and lamp departments. Each vehicle weighs 1,700 pounds and will travel 15 miles an hour. The driver is seated in the rear, while the load is carried well forward. These wagons have been in constant use for about four years.

A light delivery wagon, originally designed for the government of Argentine Republic, is given hard service by the company in connection with the erection and underground operations. It has been in commission for five years, and at the present time is quite as efficient as when first purchased.



Formerly a Fire Department Vehicle—Now used in Electric Light Work.

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The balance of the company's vehicles is comprised of runabouts which are used by foremen, purchasing agents and the like.

An experienced battery man has charge of the machines which, after the day's operations, are run to the company's garage adjacent to the plant. In the garage are ten charging plugs and about a dozen rheostats. No record of expense is actually kept. It is, however, certain, according to the statements of those in charge, that the vehicles in some instances accomplish three times the work of single horse teams and are much more efficient. All battery parts are made in the plant of the company. At least one experienced man is on duty at the garage until 6 o'clock in the evening, at which time two more come on duty and remain until 3 in the morning.

MILITARY MOTOR TRANSPORT WAGONS

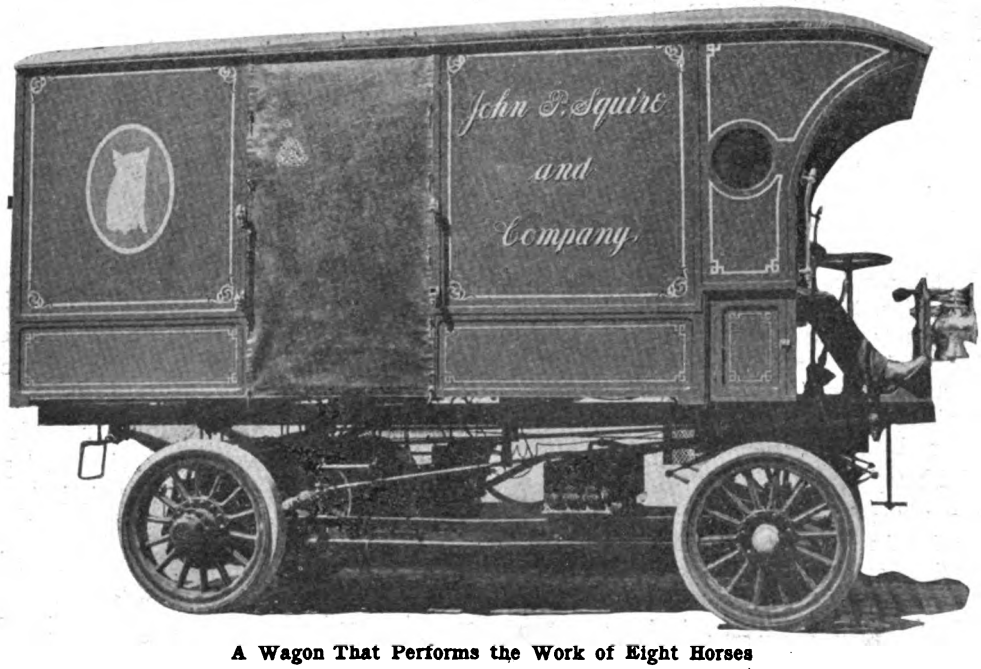
CERTAINLY it was not to inquire into the usefulness of military motor wagons that the British war office mechanical transport committee sent representatives to attend the reliability trials which were recently held in Scotland. Within the past three or four years this feature has been so thoroughly demonstrated as to render further investigation of it quite unnecessary.

The experience which the British war office authorities acquired from the use of steam transport wagons during the recent unpleasantness with the Boers, while not conclusive at that time, nevertheless made it plain that auxiliaries of this character possess many marked advantages over animal transport. Since that time, however, such wonderful advances have been made in construction as to make the early experiments just referred to appear in the nature of a comedy in which the vehicles, poorly adapted to their service, badly handicapped by lack of water to make steam, and forced to operate under the most disadvantageous physical conditions, furnished most of the laughter. It is now thoroughly recognized in army circles that the use of military motor wagons must be confined to work which is wholly suited to the vehicles. Military motor wagons, like commercial motor vehicles, perform to poor advantage when the conditions of service are too exacting.

The visit of the military experts to the scene of the reliability trials was undertaken purely for the purpose of noting the progress in mechanical construction, which has so materially increased the efficiency of motor transport wagons as to make it highly probable that large numbers of them will be employed in service from which horses can with advantage be spared. Gasoline wagons, with trailers, attracted most attention.

MOTOR POSTAL VANS IN ITALY

LETTERS and other mail matter are collected in Milan, Italy, by means of motor wagons, the interiors of which are so arranged as to enable an official, while on his way to the central office, to stamp each piece, a process which very considerably expedites the dispatching of mail from the central office.



A Wagon That Performs the Work of Eight Horses

THIS wagon, owned by an eastern provision packing firm covers a circuit of 35 miles daily, starting from East Cambridge, Mass., where the plant is located and delivering merchandise to provision stores at Reading, Medford, Stoneham, Woburn and Winchester. Before it was put into commission eight horses, four men and two horse drawn wagons were required to operate the route,the severity of the work being such that a team of horses was only available for duty a couple of days each week. The machine leaves the factory about 7 o'clock each morning and covers the entire route by 3:30 in the afternoon; whereas the teams did not reach the factory on the return trip until 6 or 7 o'clock in the evening. This made a long, wearisome day for both men and horses. The average rate of speed of the power wagon is twelve miles per hour, which is in striking contrast with the rate of travel by a heavy two horse team averaging at maximum 3 miles an hour. The average load of the power wagon is about 3 tons. In a short time four more motor vehicles will cover the Boston district, supplied by John P. Squire & Co., the economy to be obtained from their use having been so thoroughly demonstrated by a single wagon.

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The Solidity of Roads

First of a Series of Articles on the Importance of Good Roads for Heavy Motor Vehicle Traction

CAN existing highways withstand the travel of heavily loaded motor wagons? The question is of unusual importance in view of the awakening interest in the transportation of merchandize by motor tractor and trailers.

Lieutenant-Colonel Espitalier, of the Belgian army, who since the death of Georges Forestier, is very properly looked upon as the most eminent road authority in the world, recently gave deep consideration to the matter in the course of a paper which will appear by installments in these pages. In narrating the difficulties attending the heavy traffic, he says:

"The development of automobilism is closely connected with a good condition of roads, and if this is true in the case of touring cars, how much more so is it in that of heavy loads which commercial motor cars represent? If they are only able to run satisfactorily on excellent roads, is it not to be feared that many will cease to be good as soon as the traffic becomes too great? This, no doubt, is turning in a circle from which it is difficult to escape; in other words—begging the question. The problem, when placed before a man very experienced in such matters, the lamented M. Georges Forestier, the late Inspector-General of Roads and Bridges in France, elicited the following paradoxical reply:

> There are no such things as heavy-weights. They cannot exist, because the day they ceased to be the exception and heavy motor drays began to run regularly and in large numbers, that day there would be an end of good roads, and the authorities, unable to keep them in good condition, would have to interfere. Our present roads cannot withstand the continuous effect of loads of 2 or 3 tons per wheel—a small limit for commercial motors. Their effect is very different from that of vehicles drawn by horses, which simply roll along, whereas the motor car must bring pressure to bear upon the road by adherence, and push the pavement backwards. The dust raised and the mud scattered by the wheels are irrefutable proofs. Pneumatic tires are not a palliative, but an aggravation, because, though this tire is soft and smooth, only the occupants of the car derive a benefit, for the rubber adheres to the ground like a sucker and gently raises the surface materials. It acts by persuasion, which, as all are aware, is more powerful than violence.

"There are other obstacles in the way of heavy cars. A manufacturer of Nancy recently remarked:

> I have bought a 12-ton lorry, which would be of great use to me were it not for the fact that most journeys are prohibited; some because there are bridges not in condition to support such weights, and others for similar reasons.

"If existing roads cannot withstand the effect of numerous heavy cars they must be altered. How to do this is for the engineer to decide. Tarring, which gives a greater cohesion to the surface of the road, is a great improvement, though it is said the dust is not sufficiently abated for the eyes, and, again, that this dust, thus chemically treated, is a godsend to the oculist. The beau-ideal would be a homogeneous resisting surface of paving or flags, instead of the loose stones of the macadamised road, which are badly held together in a dusty gangue. There is, alas, the question of cost, at least, for construction, as maintenance of a good flag is relatively inexpensive. This may rightly cause fear when we consider the enormous length of the French roads, but in towns the adoption of flagging will soon be a necessity.

"A type of flagging which is infinitely superior to wood, so generally condemned by hygienists, is to be seen at Liege on the two "armoured concrete" bridges built for the Exhibition, and it is daily growing more common in Paris, especially at the entrances of the chief railway stations. It is almost exclusively employed for the booking-halls of the new metropolitan stations and the steps leading down to them. This paving is styled armoured asphalt, and it consists essentially of a moulding of ordinary asphalt and granitic sand incorporated under special conditions of temperature and mixing. The asphalt granite thus obtained surrounds a number of little granite pyramids, which give it body and act as an armouring, whence its name. The paving is 1 1-2 to 3 inches thick, according to the stress exerted on the road. Compared with ordinary asphalt, it has the advantages of not being greasy, not softening in heat, and of a resistance as great as that of the best Fontainebleau sandstone. But let us return to the subject of heavy motor cars with the concluding remark that the road question is not insoluble, and, though the first endeavors made some years ago to establish regular services of heavy cars failed, we must not blame the roads, but the high cost of this kind of traction at that time, and other circumstances.

"The question was not ripe five or seven years ago, whereas now there are services of motor omnibuses to some extent everywhere, which give general satisfaction. True it is that these vehicles, even when they carry 30 passengers, are only 'half-heavy.' They hardly weigh four or five tons, whilst the lorry reaches 8, 12 and 15 tons. These last-named vehicles have recently entered the arena with great success, the latest extensive tests being the commercial motor car trials which took place early in August last from Paris to Dieppe and Le Havre, returning via Rouen. In fact, it is by this quite modern system of road trials that the most difficult constructional problems have been solved, the practical necessities of the case and imperfections of the vehicles being made conspicuous in the very severe tests involved. Competitors have made comparisons, and their sense of self-esteem has been awakened. They will now work with increased ardor, and, to attain perfection, lay out much money which they would probably not have risked had they remained in their works with their monotonous surroundings.

"Who can remember the cumbersome, antiquated road locomotive, dragging one or two artillery ammunition wagons, puffing solemnly along? This was about the state of affairs when the English employed traction

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engines in the Transvaal for army supplies. Already this strange machine was being lightened, but at that time any solution of the problem of transport of commercial products was regarded as impossible except by traction engines. But diversity of commercial affairs, the scattering of producing centers and consumers, and the branching roads leading to the various consignees are all so many reasons which, in the majority of cases, involve division, and very often adoption of independent, self-contained, self-propelled vehicles of relatively great individual capacity. These motor wagons, more than tractors, introduced problems yet unsolved. The first 'heavy-weight' trials were instituted in France in 1897 by the Automobile Club, at Versailles, and, as in all new experiments, men of alert minds sought each other. The difficulty was to convince people that heavy vehicles have not to travel quickly; that it is impossible to classify them, as they are varied as the needs to meet which they were built; that their chief qualities are resistance to stress, few and easy repairs, small consumption of fuel, and, put briefly, a low cost per ton-mile. The following year—1898—another similar series of tests was made at Liverpool with four lorries, all steam, thanks to the initiative of the Self-Propelled Traffic Association. The point to note in these early competitions is the great predominance of steam. Internal-combustion engines only seemed suitable for light cars; but opinions change.

"Since 1898 'heavy-weight trials have taken place yearly, each bringing a new improvement. We must note the endeavors made to utilize alcohol which, in October, 1900, were made public by the Paris-Rouen trials, followed by the Paris-Roubaix trials in April, 1901. In October of the same year the Ministry of Agriculture trials brought out seven alcohol-driven commercial motors, which made a particularly severe journey over uneven roads in a brilliant manner. Let us also mention the interesting 'heavy-weight' trials from Beauvais to Paris on May 10, 1902. Remarkable trials have also taken place in other countries, and they help to demonstrate how industry eagerly awaits the success of this type of vehicle, which meets a real need. All this activity and constantly-renewed toil have not failed to yield advantages, evidence of which can be observed at each annual Salon. It will suffice to mention the magnificent specimens exhibited at the Brussels Salon last year, where the omnibus section especially was brilliantly represented."

(*To be continued.*)

AUTOMOBILES IN POSTAL SERVICE

THE post office department at Washington has given permission to a manufacturing firm in Massachusetts to demonstrate whether or not an automobile can be used successfully in the rural free delivery service. One of the machines will be tried on several of the routes in Maryland and Virginia. The carriers will be taken over their routes by a representative of the company and will then make reports upon it to Postmaster General Cortelyou.

Fourth Assistant Postmaster De Graw, under whose direction the rural free delivery service comes, states that permission was given to this same company to make a trial of the machine last January, but that on account of the large amount of the business on hand the company was unable to make the test at that time. When the request came this month Gen. De Graw informed the company the department was willing to grant, without a test, that the machine would work all right at this time of year, and therefore he did not believe a test was necessary. The firm desired, however, to make the trial both now and next winter.

TROLLEYLESS INTERURBAN CARS

THE end of overhead equipment for interurban car lines is signalized, it is said, in the determination of the directors of the Detroit & Lansing short line and the New Detroit, Ann Arbor & Adrian line to use the Union Pacific gasoline car.

This is expected to reduce the cost of building and equipping the road nearly 40 per cent, or from $32,000 and $35,000 a mile to $20,000 a mile.

The work of laying track will be arranged for by the directors as soon as the new cars can be contracted for. The new cars, it is expected, can make Ypsilanti thirty-five minutes quicker than the cars now in use, and can reach Lansing in two hours and fifteen minutes.

One gallon of gasoline, it is said, will keep the car in operation four miles. The car can reach forty-five miles an hour with two fifty-horse-power engines, and with four—the average of an interurban car is 200 horse-power—a speed of seventy miles an hour can be reached.

The cars built in Omaha have climbed the mountainous stretches of the Union Pacific without difficulty. They are easily controlled.—*Detroit Journal.*

PARIS NOW HAS MOTOR BUSES

ELEVEN motor buses were put in commission on the streets of Paris on June 11. They perform the work of eighteen horse-drawn buses.

Wagon With Searchlight..

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Care of Storage Batteries

Practical Suggestions for the Proper Maintenance of Batteries in Electric Power Wagons

OLD electrolyte should be saved and used *only* in the hydrogen generator for burning up the battery. Fresh electrolyte should replace it in the battery. Impurities collect in the electrolyte. No pains should be spared to get the acid used in the electrolyte as pure as possible. The water a battery is washed in may be the cause of trouble. It is advisable to rinse the elements and jars in distilled water, after having first washed them thoroughly with any clean water. The elements should then be assembled and put in the jars again, and burned. The same gravity of acid should be put in the cells as was taken out before they were washed, and the battery should be put on a slow charge and the same instructions followed as given for forming the battery when new.

WHAT LOW ELECTROLYTE GRAVITY INDICATES

If the electrolyte is low in gravity, assuming that the sediment is not up to the plates, it is evidence:

(1) Of insufficient charge, or overdischarge, or allowing to stand in a discharged condition, or a combination of these abuses; any of them mean that there is acid in combination with the plates, which should be brought out into the electrolyte, this being accomplished by giving the low cells a long charge at quarter the normal or four hour discharge rate. Continue charging until the gravity of the electrolyte stops rising; then adjust to normal (1.300 sp. gr.) by drawing off some of the electrolyte and adding water if it is above normal and by adding acid if it is below normal.

(2) Of a leaky jar or sloppage, the loss having been replaced with water alone. As a rule, more than one cell will be found in this condition, and all of the weak ones should be grouped by themselves and charged in series as a separate battery. If there is not enough resistance in the charging rheostat to cut the current down to the proper point, use water resistance in series with it. While a cell is being treated, when possible, the cover should be removed.

TIME REQUIRED FOR CHARGING

The time required for a charge will, of course, depend upon the amount of the previous discharge. If this has been two-thirds of the rated capacity of the battery, about three hours at the starting rate and an hour and a half to two hours at the finishing rate will be necessary, i. e., from 10 to 15 per cent more charge than the amount taken out on the discharge is required as a usual thing; it is advisable, however, to prolong the charge for an additional hour or two, about once in every two weeks.

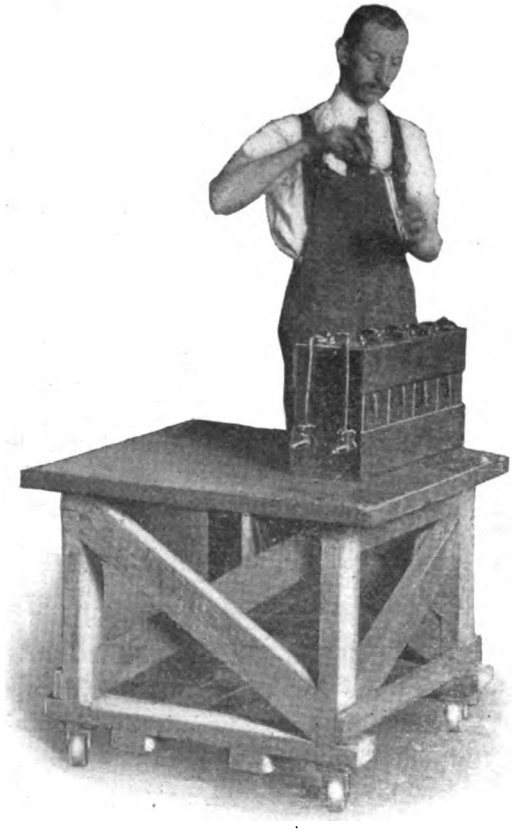
THEORY OF ELECTROLYSIS

An electrolyte is a chemical compound capable of acting as an electrical conductor. While so acting it undergoes chemical decomposition. This phenomenon is called electrolysis. When sulphuric acid is electrolyzed it is first split up into hydrogen and the radical sulphion; the latter combines with the water present and reforms sulphuric acid, and oxygen is liberated. The modern theory of electrolysis assumes that in an electrolytic solution there are always ions which wander around promiscuously, until the application of an electric current directs their wanderings into certain definite directions. The theory also states that the conductivity of electrolytes is due to the presence of the ions and that the non-ionized portion do not conduct.

VOLTAGE READING OF INDIVIDUAL CELLS

As an additional indication of the relative con li-tion of the cells in a battery, the voltage of each cell should be read with a low-reading voltmeter at least once a week; these readings should be taken either at the end of a discharge or at the end of the charge, after which the gravity readings, referred to in the paragraph above, are to be taken. If any cells read lower than the average, it is an indication of trouble. Voltage readings, either on discharge or charge, must be taken with the current flowing.

Fifteen electric wagons are operated in the Paris mail service between railway depots, the main office and sub-stations.



Hydrometer Test of Specific Gravity of Acid.

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Their Attention

A LEAKING carburetter float is quickly discovered by putting the float in boiling water, when gasoline vapor and air will issue out in the form of bubbles. If after the hole has been closed, a slight leakage follows, and it is impossible to locate the fault, a good method to prevent further trouble is to give the whole float a good coating of nickel by electro-plating it. This closes up the small porosities better than any solder.

THE UNACCOUNTABLE FAILURE OF PLUGS

Sparking plugs occasionally fail for no discoverable cause, for it cannot be determined whether the electrical leakage is due to a very slight, hardly visible deposit of carbon or after long use to some molecular change in the porcelain insulator, which appears to rob it of its power of insulation. The remedy in these mysterious cases is obvious—fit a new plug.

LOSS OF ENGINE POWER

When compression is good and ignition right, but at the same time the engine will not pull up to its form, there is very little doubt that the carburetter is at fault. When running light, i. e., out of gear, the engine will turn splendidly. It may show every evidence of life, and yet as soon as it is driving the car it will fail miserably. The reason the engine runs well when there is no load is because it has practically nothing to overcome except its own weight and friction, so that a very small supply of explosive mixture will keep it running at speed. A case of this kind came to notice recently. After trying everything he could think of the driver found that the loss of power was due to the rod which worked the throttle being loose. The throttle, when apparently wide open, was not really giving full aperture, and consequently the engine was being starved.

HOW TO REMOVE A BROKEN SCREW

In dismantling an engine sometimes a screw or stud will break off short, and difficulty will be experienced in removing it. Generally there is not enough projecting metal to enable a good grip to be obtained with pliers, so that a saw cut has to be made in it for a screwdriver. If there is not even enough metal for this, a hole should be drilled vertically in the screw, and the triangular or rectangular tang of a file inserted, which will generally obtain sufficient hold to enable the screw to be removed. If a left-hand flat drill is used—that is, one cutting counter-clockwise—this alone will often be sufficient to bring out the screw.

TO PRESERVE TIRES FROM RIM RUST

To preserve tires from rim rust and consequent rotting of fabric, use aluminum enamel paint. Clean the inside of the rim with emery cloth. Apply the paint with a brush, spreading it into the recess of the rim. While the paint is drying, coat the bead and inner flat space of the tire. When dry apply the tire.

Stretching a Telephone Cable in a Street Conduit.

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Information to Buyers

THE HEWITT MOTOR TRUCK

MANY interesting features of construction are to be found in the 25 hp. gasoline 3-ton truck made by the Hewitt Motor Company, of New York City. Unloaded, the vehicle weighs about 5,000 lbs. The engine has four cylinders, set vertically, with small bore and long stroke in order to get the greatest amount of power with the least fuel consumption. The motor, which is built on the marine steam engine principle, is without crank case, which gives easy access to the crank bearings and permits the adjustment of any of them without dismantling the engine.

The cam shaft is operated through a train of spiral gears with very broad face on ample wearing surfaces. This obviates the noise and wear of spur gears. Ignition is supplied in three forms—touch spark, operating from a magneto or by means of a switch to a battery and coil, and the usual jump spark. It is, therefore, practically impossible to stall the truck by breaking down of ignition.

The motor is placed beside the driver's seat, and not in front of the truck. The fuel tank, placed under the driver's seat, has two compartments, so that if one should develop a leak the other can be brought into service. The track of the truck is 66 inches; the wheel base 120 inches; the wheels 36 inches diameter; the length of platform 12 feet; its height from the ground 43 inches, and its width 6 feet.

The entire motor is enclosed in a steel case, which prevents dust from getting into any of the bearings. This compartment is closed and securely locked, so that the driver cannot make any adjustments to the motor. Where a number of trucks were being used an inspector would be expected to examine the motors every day and see that they were in proper running order. By removing six bolts the motor can be lifted from the frame. With an extra motor the time required to change motors would probably not exceed half an hour. The transmission is through the medium of a universal shaft to the gear box. This box has two speeds forward and one reverse controlled by three foot pedals. These pedals are interconnecting, the throwing in of one pedal releasing any other pedal which may be engaged. In this way the possibility of having more than one speed in at a time is entirely avoided. Nor can careless operators injure the transmission.

The usual foot clutch and a hand-change gear is also done away with. The pedals connect with friction bands placed on the outside of box, and the leverage is so arranged that by throwing in the pedal quickly it is impossible for them to grip suddenly. The action of these clutches is very gradual. The high speed clutch is arranged so that should it be thrown in by mistake it will take hold solidly and slip over a distance, say fifty or sixty feet, until the truck is accelerated up to the speed of the motor. With these slipping clutches it is impossible to stall the motor.

The transmission from the gear back is through a universal shaft to the bevel driving cross axle and from here back to rear wheels by chain.

Rear wheels are equipped with twin tires, each 3½ inches wide. Front wheels are equipped with single tires six inches wide.

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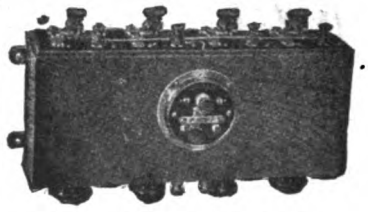

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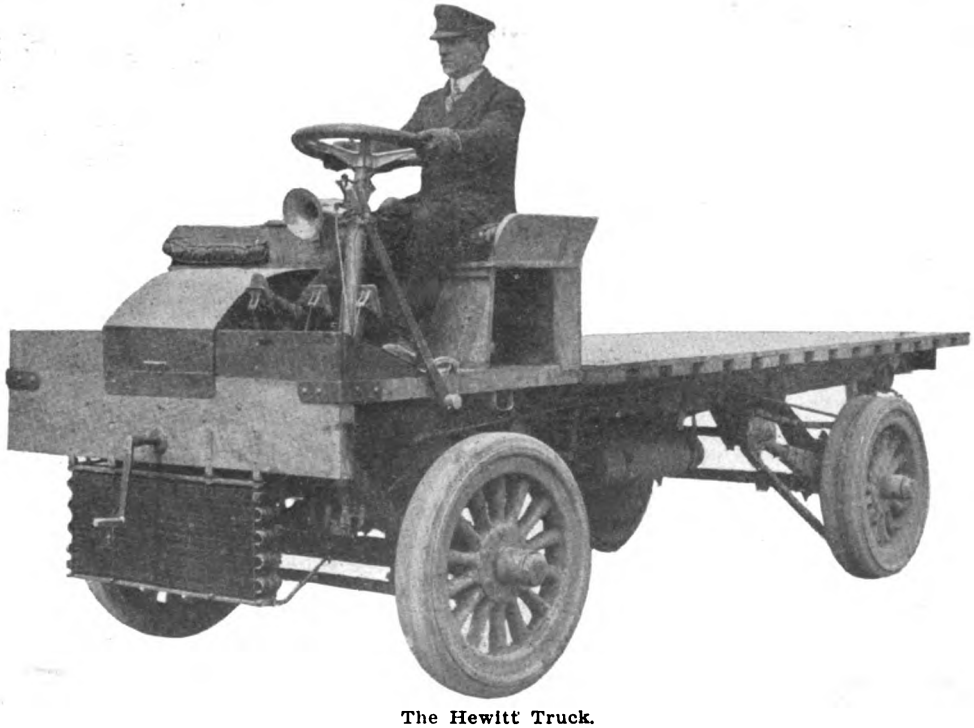

The Hewitt Truck.

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ADVERTISING RATES ON APPLICATION

WALTER WARDROP, EDITOR AND PUBLISHER

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Ridiculous Statements

Thomas A. Edison's Strange Interview on the Subject of His Recent Discovery of Cobalt

IT seems incredible that Thomas A. Edison could have been correctly reported in the following interview which appeared in a Philadelphia paper of recent date. Whatever failures the great inventor may have made in the course of the last fifteen years his previous record would at least justify us in expecting that he was qualified to think scientifically and to weigh evidence. As, however, neither of these qualities are exhibited in the statements ascribed to the "Wizard" it would be charitable to assume that he was misquoted.

If cobalt is as thick and as rich in North Carolina as I believe I will reduce the weight of storage batteries in automobiles 50 per cent and the cost of traffic in cities 55 per cent.

It can be seen very readily that more automobiles and electric vehicles will be built because the cost will be placed within the reach of many people who cannot afford to own them now. The electric vehicles have been under a great handicap because of the very heavy storage batteries we were forced to put in them, and also on account of their high values. Under the present plans electric automobiles cannot be made without a large outlay of money and that has kept the majority of the people from using them.

When I can equip an automobile propelled by the cobalt system the weight will be one half, thereby giving the new machine an enviable advantage over the ones now in use. And when the price is reduced so as to place them within the reach of everybody it means that the horse is a thing of the past. The crowded streets of the cities will be cleared, and that will mean a great thing in some of our largest towns.

I have left a force of men in four counties in this state where I found the mineral, and they will make thorough investigations as to the quantity. They will report to me, and I may possibly return later in the summer and further investigate my discoveries. I am fully confident that what I have found will enable me to start work on the new vehicles propelled by cobalt batteries.

Most of the statements in this interview are so wide of the mark, so inconsistent with each other, and so independent of the conclusions arrived at, as to be ridiculous. They read as if the "Wizard" had not the slightest conception of the present state of affairs in the electric vehicle industry which, so far from languishing, as he apparently imagines, is actually enjoying a very decided boom.

It is a platitude to assert that low prices lead to increase in sales. The point to be observed is that prevailing prices of electric vehicles bear a reasonable relation to the prevailing prices of vehicles with other forms of power, and have not operated visibly in the prevention of their sale for the purposes for which they are suited.

Does the "Wizard" share the almost obsolete misapprehension that the merchandise load efficiency of an electric vehicle is materially less than that of other vehicles of the same power, rated to the same standard? Does he suppose that a pound of lead is heavier than a pound of feathers?

One cannot help wondering if the great inventor told the reporter in what way the use of cobalt is going to operate to materially reduce the price of electric automobiles. The price of a lead storage battery in an ordinary type of pleasure vehicle is something less than 20 per cent of the retail price. This marvelous extension in electric vehicle trade, if accomplished in the manner the reporter describes, has got to be realized on this 20 per cent. If it were all wiped out a $1,000 automobile could then be sold for $800, and there are undoubtedly a few more people who would pay $800 than there are who would pay $1,000. If the question of purchase is as close as this, however, experience indicates that the majority of prospective purchasers would simply go without.

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The interview throughout breathes the idea that at last such a reduction is going to be made in the price of automobiles, by the use of cobalt, as to put them on the same basis as sewing machines; this in the face of the fact that cobalt, although well known to commercial science, and some compounds of it well known in certain arts, as a metal has practically no commercial place. It is hardly likely that any material reduction in price can result from the use of cobalt for the benefit of the present generation in view of the fact that the whole question has got to be worked from the mine to the end of the series.

Interviews of this sort should be left to well informed reporters. The "Wizard" should not be held up to ridicule as being either ignorant or disingenuous, which is the only alternative to the supposition that his remarks about cobalt have been most inaccurately reported.

The "Wizard" is a favorite subject for the irrepressible interviewer. His fertile mind can always be depended upon for "stories" which thrill the imagination and are instantly telegraphed and cabled all over the world. Before the cobalt yarn was laid on the wires this highly interesting little trifle had its brief hour of popularity:

Edison has once more astounded the world by his latest and most marvelous invention, known as a "Fly Paralyzer." The invention consists of a small storage battery, triangular in shape. A live wire, 6 1-16 inches in length is shot out of a box by pressing a button, and instantly kills whichever fly it strikes.

Truckmen Are Hostile

National Body of Team Owners Does not Consider the Power Wagon Practicable at Present

As a class truckmen are not favorably known for their graces of mind. The reeking atmosphere of the stable seems to act as an anodyne to reflectiveness. Still one would think that in a convention composed of the largest trucking concerns in the country something more than rudimentary thought concerning the usefulness and economy of the power wagon would crop to the surface.

There are many shrewd and even intellectual men enrolled in the membership of the Team Owners Association of America, the national body which recently met in New York to consider many matters of the first importance to their business. If they were present at the sessions of the organization they must have been amazed upon observing the lack of discernment shown by the majority of their brethren in deliberately refusing to recognize the motor vehicle as an auxiliary in work which, of all forms of transportation known to students of city traffic, is most disadvantageously performed by horses. Their astonishment must have given way to smiles when they recalled how many progressive truckmen and team owners throughout the country were actually employing motor vehicles in combination with horse drawn wagons. Doubtless there were many on the floor of the convention who regarded it as good diplomacy not to attempt to abate the prevailing hostility to the power wagon.

After listening to an address on the "Commercial Automobile in Practice" from a member who evidently favored its employment, but did not succeed in awakening much interest in his hearers, the convention decided, to borrow the language of the New York Herald—a paper which misses no opportunity to speak a good word for the horse breeding interests—"that the practicable automobile had not yet arrived." If by this it was meant to imply that the "perfect" motor vehicle is not yet plying the streets, the charge would undoubtedly lie. But, happily, it is not necessary for a piece of mechanism to be perfect before it can be made useful in industry. Locomotives are a long way from finality of design; yet their employment is singularly economical. The problem for truckmen and teamsters is not the discovery of a faultless power wagon, but the proper adaptation of the vehicle as it stands today to service where its advantages are easily demonstrated.

The profound ignorance of the majority of truckmen assembled in New York is perhaps best shown by the fact that they concentrated their attention upon the shortcomings of the vehicle, paying not the slightest heed to its economies which exist in spite of these shortcomings. Beyond a doubt a competent analyst of draft animal and power wagon operating costs could have demonstrated, out of experience of the past, that every concern represented on the floor of the convention was losing money hand over fist by neglecting to take advantage of the superior utility of motor vehicles. But, unfortunately, the opportunity was lost and, like the ostrich, the teamsters stick their heads in the sand and imagine that the danger they do not observe cannot possibly harm them. By and by, when their permanent investments are so seriously impaired by the enlarged use of motor wagons as to cause a heavy shrinkage in values, they will regret the blind and unreasoning prejudice which prompted them to such rash action.

The situation of a large transfer and trucking company in Cleveland is called to mind in the consideration of these matters. It does a thriving business in transporting merchandise from depots to factories and warehouses. The growth of the city, however, is annually so great as to tax its resources to the utmost. As the buildings in which its horses and wagons are stabled cannot conveniently accommodate any more equipment, the concern is confronted with the alternative of moving to more commodious quarters or letting rivals flourish on

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the surplus business. Two years ago this establishment sought the assistance of an unusually competent adviser, laying the facts in front of him and asking if the time was ripe for superseding draft animal service by power wagons. The dread of competition, rather than the natural inclination to make progress, inspired the question. When answer was made in the affirmative the manager of the establishment, who is as innocent of mechanical knowledge as a sucking babe, immediately began to make inquiries among his acquaintances concerning the "best" form of power to be used and the paragon vehicle in which it was embodied. He is still looking for the perfect motor wagon, and begrudging competitors the success they are obtaining at his expense. In all probability, unless the spirit of his investigations undergoes a radical change, the competition he cannot check will eventually compel him to employ power wagons in defense of his business, and when he does so he will doubtless congratulate himself upon having so nicely judged the time for grabbing the streaming hair of Opportunity. If rivals also grab a wisp of it his sagacity will be confirmed—moyah!

The discussion of the paper referred to was quite as languid as the interest shown during its reading. The representatives of a few establishments related wierd tales of how vehicles broke down and had to be hauled back to the barn by horses. Nothing harsh about this impeachment. Instead of indicating the unreliability of the machine it betokened inexperience on the part of the operator. Motor trucks are not built to stagger along in work, but to perform their duties continuously, and this they do with remarkable precision if they are cared for with reasonable intelligence. All of the evidence bearing upon the unreliability of the motor wagon was as inconclusive in character as that just mentioned. It would seem, therefore, that the convention in declaring the vehicle unfit for service disregarded the evidence of everyday experience.

We are accustomed to hearing anthems of praise from truckmen over the reliability of the horse. The fact of the matter is they are so familiar with its limitations that they have grown to tolerate them. The proposal to change from draft animal service, with all its disadvantages, to the power wagon, with all its unknown terrors, must appear to the average truckman as if the matter were but an exchange of devils, a change from one with which they are familiar to one with which they are utterly unacquainted.

After their deliberations were concluded, and the unreliability of automobiles had been written boldly on the records of the convention, the company viewed the fair city of New York from motor buses which, strange as it may seem, didn't break down under the august burden they were carrying.

Barren Exercises

Automobile Club of America Reported to be Preparing to Hold Public Trials in the Fall

RUMOR—the lying jade—advertises the Automobile Club of America as grooming itself for the barren honor of conducting a series of public trials for commercial motor vehicles. Time, the approaching fall; theater of action, not yet selected.

The whole project is as vague and purposeless as experience has taught us to expect from an organization which is profoundly ignorant of the conditions governing power wagon employment. If no obstacle is placed in the way to prevent the consummation of the club's ripening plans, we may expect to hear from this high authority that certain wagons have earned "certificates of reliability" by traveling 35 miles or so a day for five days without so much as blowing out cylinder heads or biting their drivers. Should vulgarly inquisitive persons wish to know something of the economy of the vehicles they are at liberty to multiply each day's operating costs by the number of working days in a year, and subtract the cost of operating horse wagons during a like period. This is the lightning method of calculation which club officials usually recommend to the public. They are neither school masters nor students. It is their business merely to provide holiday amusement for gawks. And whoever quarrels with the silliness of their circus can go and be hanged for all they care.

The conclusions to be drawn from public "trials" of this character are so vague and general in character as to be of little value in forming a judgment which will help in decisively establishing the inferiority of draft animal service. Economy, durability and reliability are being demonstrated daily in actual commercial work. It would seem, therefore, that methods which have been proven of dubious value in popularizing the touring car are not required to confirm the utility of the power wagon.

Everyone with the slightest interest in power wagon construction or use must feel impelled to believe that so many of them would not be employed if their success was at all problematical. Hence the mere certification that a vehicle will travel a given distance in a given time and ascend grades of given declivities, cannot add in any way to its reputation for utilitarian accomplishment.

In proof of the lack of interest which manufacturers show in these exhibitions, witness the paucity of wagons which appeared in the seven days test recently concluded in France. Only 25 vehicles were sent to the starting mark. There were over 50 in the trials of a year ago. The products of the best known concerns in Europe were conspicuous by their absence. Yet this was an international event. On the other hand, several new concerns, evidently unwilling to miss the opportunity for advertise-

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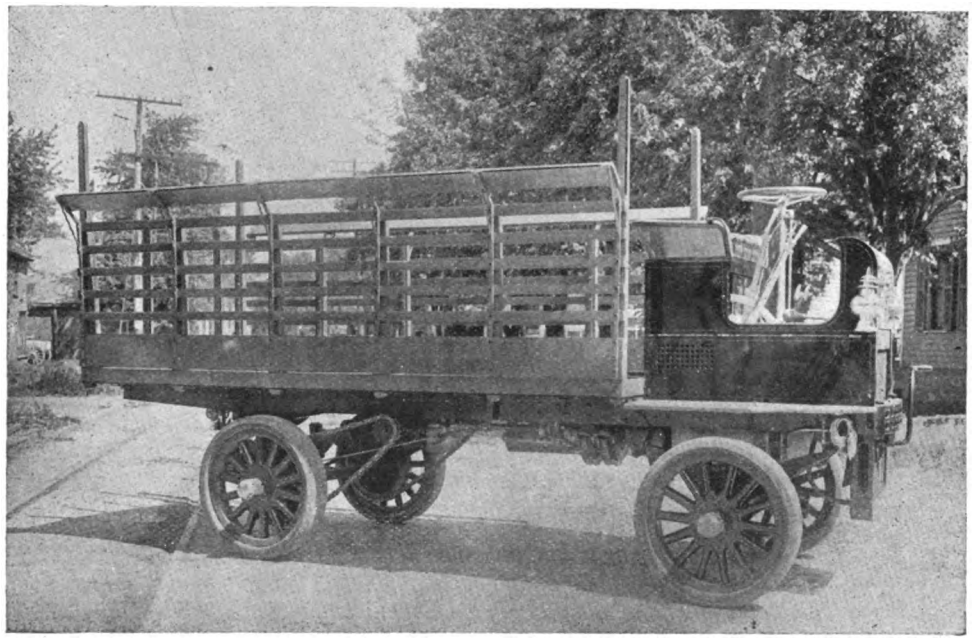
ment, sent their vehicles over the course, a distance of 263 miles, which was to be traversed in the most leisurely manner. It is absurd to pretend that these trials were of the slightest value in ascertaining the durability, efficiency or economy of power wagons, and doubtless it was the recognition of this fact which prevented such establishments as de Dietrich, Gillet-Forest, Gardner-Serpollet, de Dion-Bouton, Krieger, Clement, Gladiator, Daimler, Cotterau, Cohendet, Dufour, Delaugere and many others from entering vehicles in the "competition." Not even the hope of winning the "regularity" prize—awarded to the manufacturer whose cars, entered in three classes, covered seven stages of the journey within the maximum time at lowest recorded fuel consumption per ton mile of load carried—could entice these well known houses to participate in an event which dear experience taught them was without value.

As each entrant was at liberty to send three vehicles to the starting line, one in each division of competition, it is unlikely that more than twelve out of a hundred or more concerns manufacturing commercial motor vehicles were represented at the much touted trials.

The customary "stunts" one witnesses at reliability trials possess no interest whatever for merchants who are well aware that power wagon service calls for the special adaptation of vehicles to the particular duties in which they are to be employed. This fitness is in no way helped by performances which merely register the quantity of fuel and lubricant consumed in traversing a measured course, the number of stoppages and cause thereof, and a lot of miscellaneous data which is as valueless as it is misleading.

The Automobile Club of America should pause before it proceeds further in the commission of its cherished nuisance. It should recall the unanimity with which manufacturers recently condemned the practice of giving service demonstrations, which certainly possess more value than the proposed trials, but which nevertheless were voted worthless for all practical purposes.



Five-Ton Gasoline Truck in Brewery Service

GASOLINE trucks are not commonly observed in brewery service. For years electric wagons have been widely employed in such work. The five-ton gasoline vehicle operated by the Lion Brewery Company, of New York City, therefore, offers an interesting study. Wagons of this type will undoubtedly be extensively used by concerns which find it necessary to make deliveries in outlying districts where the limited battery power of electric wagons could not take them. A number of brewers now employing electrics cover these remote districts by horse-wagons, over-looking the fact that such service is peculiarly well suited to gasoline trucks. A Cleveland brewery, with considerable trade in the outskirts of the city, commits the error of sending its electric vehicles over unpaved and sandy roadways which soon exhaust their power and give opportunity for exclaiming against their limited usefulness. The natural result of such imprudent use of the vehicles is that on days when these rural excursions are made the power wagon service is crippled, and horse-wagons are employed as auxiliaries. One such gasoline truck as that shown above would wonderfully improve this service, leaving short hauls to be cared for by the vehicles with limited mileage and long hauls to the prime movers. The wagon operated by the Lion Brewery Company was built by the American Motor Truck Company. It is geared to travel at 8 miles an hour. The frame, axles, springs and wheels are very substantial, as it is expected six ton loads will not be uncommon. All wheels are fitted with rubber tires, 7 inches wide. The engine develops 36 hp., is of the four cylinder vertical variety with 5 inch bore and 6 inch stroke. The crank case is parted diagonally, so that when the cover is removed every bearing on the crank shaft and cam shaft is accessible for inspection, repair or adjustment. Moreover, through the peculiar construction of the crank case, and on account of the fact that the crank shaft is not in line with the center line of the cylinders it is possible to readily remove any or all of the four pistons through the crank case without removing the crank shaft or the cam shaft, or requiring any other manipulation than removing the connecting-rod cap. This feature is distinctive

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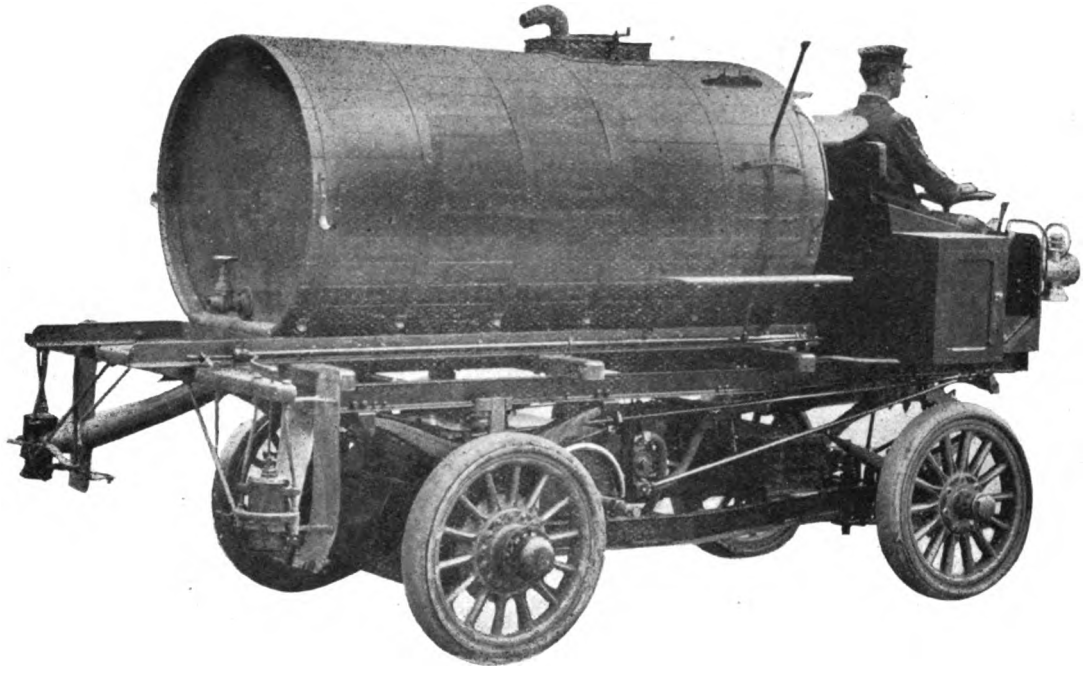

New Type of Sprinkler

Prime-Mover Vehicle Used in the Service of the Massachusetts Park Commission

JUST as Hartford enjoys the distinction of being the first American city to employ the electric street sprinkler, so Boston is entitled to credit for first perceiving the advantages of the gasoline motor vehicle in the same service. Actual tests of the vehicle shown above prove that it will perform the work of three to four horse drawn watering carts and sprinkle in a perfectly even manner streets varying in width from 30 to 35 feet. It will cover a distance of 200 miles without replenishing its fuel supply.

The vehicle was recently delivered to the metropolitan park commission of Massachusetts. It is in use on the road stretches of the Revere Park reservation and is the product of the Knox Motor Truck Company, of Springfield, Mass.

In a recent issue of this paper it was pointed out that one of the difficulties attending the employment of horse drawn street sprinklers lies in the inability of the driver to adequately control the water supply, which is varied by the uneven gait of the animals. Thus, if the horses are tired, the driver is compelled to regulate the flow by manipulation of control devices. This difficulty is obviated by the employment of motor street sprinklers, as their rate of travel can be accurately regulated.

The speed of the motor sprinkler, which performs its work at a rate of travel not to exceed 6 to 8 miles an hour, is three times as great as that of a horse drawn sprinkler. This is the most important measure of its economy, implying, as it does, the utilization of fewer vehicles to lay the dust of a given linear surface and by reason thereof the employment of fewer horses and attendants.

The tank is mounted on a 3-ton chassis fitted with 24 hp. motor, sliding gear transmission, spur gear drive to the rear axle, and selective control giving three forward speeds and one reverse. The front axle is drop forged, I-beam section. The chassis frame is of 5-inch channel steel, and the body frame 4 inch channel steel. Full elliptical springs are fitted to the front of the chassis, semi-elliptical to the rear. The wheel base is 9 1-2 feet, the tread 58 inches, the wheel diameters 36 inches. The tires are 7 inch solid rubber on the rear and 5 inch solid rubber on the front. The total weight of the vehicle, without load, is 6,000 lbs.

NEARING THE 500 MARK

AT the last census of motor buses in London the total of vehicles employed was found to be 484—an increase of 31 in two weeks.

London Motor Omnibus Co., Ltd.	122
London Road Car Co., Ltd.	74
London General Omnibus Co., Ltd.	81
London and District Motor 'Bus Co., Ltd.	38
Thomas Tilling, Ltd.	27
Great Eastern London Motor Omnibus Co., Ltd.	30
Star Omnibus Co., Ltd.	22
Associated Omnibus Co., Ltd.	20
London Power Omnibus Co., Ltd.	15
Birch Bros., Ltd.	13
New London Suburban Omnibus Co., Ltd.	8
Victoria Omnibus Co., Ltd.	7
Other owners	27
Total vehicles in use	484

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The Inferior Horse

Useful Life of Draft Animals in Pittsburg is Five Years—Diseases Which Afflict Horses

FROM the pages of a publication which esteems the horse as a beast of burden, and correspondingly deplores the use of the power wagon in its stead, we gather some highly instructive information concerning the period of usefulness of "man's best friend" in such a city as Pittsburg, where hills abound and street surfaces are not all that might be desired.

It is frankly admitted that the average life of a horse in Pittsburg does not exceed five years—family pets and others of the equine aristocracy barred. Contrast this with the period of a power wagon's activity, which, in the case of an electric vehicle, may be extended until frame and axles collapse. Or compare it with the useful life of a gasoline wagon, which, given that degree of care which its mechanism demands, will yield a mileage heavily in excess of that afforded by the horses it replaces, a tonnage to correspond, a speed three times as great, and service years extending much beyond the duration of draft animals.

In an attempt to excuse the shortcomings of the horse the publication in question marshals a lot of interesting information pertaining to local teaming conditions, every one of which is practically an indictment of the brute, inasmuch as the conditions complained of have been brought into being as an accommodation for vehicular traffic as at present most commonly observed. Plaint and accusation are as follows:

Pittsburg is looked upon as the best horse market in the country. A good, sound horse will bring any price that is asked, and bring it quickly. But the horse must be sound. That is the one essential demanded of horses that are to be worked in Pittsburg.

Besides being the best market for horses Pittsburg is also the hardest city in the world on these animals. The average life of a working horse in Pittsburg is five years. This story is meant to deal exclusively with working horses; so these figures cannot be applied to family pets or others that are only worked infrequently in private vehicles. The topography of the vicinity, in the first place, is responsible for the killing conditions. The amount of the heavy hauling is another reason. Both these demand that the thoroughfares be paved with very hard stone, and it is the paving that measures the span of usefulness of a horse in a big city.

The surface of Pittsburg's streets is notoriously uneven. Heavy hauling, constant tearing up to lay sewers, wires or conduits, and the system of washing the streets, have caused the undulating top layer that plays such havoc with horses. Belgian block is perhaps the most adamant of all paving stones, and this type of street is more common in Pittsburg than in any other city in the Union. It is a horse's travels much more than his hauling that determines his condition, so that those who deal much with horses must make a study of bruises, hurts and diseases resulting from streets with uneven surfaces and thoroughfares cut up with street car rails.

All the horses brought into Pittsburg come from the country. This is natural, as horses are seldom bred in the big cities. So it is apparent that every horse only starts real life when he enters a big city. Slipping on street car tracks wrench their muscles and render them lame. One-third of the horses in Pittsburg suffer from this species of disability at frequent periods during their lives. One big firm lately had nine out of 27 horses in the barn at one time with sore shoulders, and another firm that has 180 horses always in its employ has replaced 35 unsound horses since the first of last November.

Some of the poorest, most scrawny-looking animals seen on the streets are going through their period of probation. If they are good, they "come around," as horsemen say. During the early months of their city life they get sore all over, and some of them that appear hopeless cases are sent to the country if they have made a good impression upon their owners. Many of them build up nicely in the field and dirt roads that would never be any good if kept in the city in the hope of getting them in shape.

The state veterinarians and the Humane Society agents are the men who keep a watchful eye on Pittsburg horses. Horses found with glanders are immediately condemned to be shot. There is no recourse from the verdict of the state veterinarian. When he condemns a horse the animal must be killed. The state allows owners to appraise the animal, but never pays more than $40 for it. Humane agents watch for horses with ringbone and spavin. Animals with these diseases cannot remain in Pittsburg, and their owners sell them cheaply to be shipped away.

It is worthy of note that for the first time within the memory of horsemen glanders has made its appearance in this vicinity and is killing many animals. The disease is not so much in the city as in the suburbs. A Bellevue contractor recently had 17 horses shot because they were thus afflicted.

This trouble is epidemic at present among the mules in the hard coal country.

A horse's hoof is a composition of hundreds of thin layers of hard fibre, and it causes a city horse more trouble than the feet of men. Constant thumping on hard surfaces causes corns in the tender part of the hoof, and the horseman must prune and pare these corns until they disappear. They are as sore as any corn on human pedal, and when found to be incurable they incapacitate a horse for further use in the city. Many horses pick up nails in their coffin-joint and in most cases die of lock-jaw.

Many devices are used to cure sore feet among horses. Mud is the most healing of remedies, and in most big city stables there is at least one mud stall. Here the animal with sore feet is allowed to stand for two or three days in deep mud, and he enjoys it. Obstinate cases require the shipping of the horse to the country, and when a horse is sent away it is invariably to a farm on which there is a swamp. The horse will quickly find this boggy section, and nothing can coax him from it until the pain leaves his feet. Horsemen say the mud, or the virtue of the soil, takes fever out of the feet and restores them to their natural condition. Tan bark liquor, vinegar and oil-meal are used to cure sore muscles and sprains. The liniments are rubbed in with a sponge and the horse is wrapped in heavy blankets and allowed to perspire freely for a day or two. This draws out the soreness and makes the muscles pliable.

Some horses that in the barn have the appearance of being "all stoved up" and that start out painfully, are sore only for a short time. Such horses often cause disputes between the humane agents and the owners, and are sore only for a short time after leaving the stables.

Life has become harder for horses in Pittsburg with the growth of the city. With the extension of the suburbs trips of 12 or 15 miles often have to be made, and made quickly. People are impatient to have their trunks taken home and the demand for speed adds much to the burden of the horse.

The most interesting feature of the horse story is that concerning their disposition after they are declared unfit for city service. Every month carloads of horses, suffering from various ills

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and diseases, leave Pittsburg for Baltimore, whence they are taken by sea to southern ports and sold. All through the south horses that for a time, long or short, hauled wagons through the streets of Pittsburg, are sold to small farmers and planters and spend the remainder of their days in the broad fields of cotton and sugar in the sunny south.

One paragraph in the foregoing lament strikes the observer with more force than any other, inasmuch as it definitely fixes the limitations of the horse in city service. It is pointed out that life is becoming harder for draft animals in proportion as the city grows in commercial importance. If, as it is stated, quick trips of 12 to 15 miles into the suburbs are bothersome to the horse, his inadequacy for any kind of city transportation service is sufficiently well proven to justify the general introduction of power wagons.

The author of the article in question unconsciously hits the nail on the head when he implies that speed, and ever more speed, in the moving of merchandise is one of the marked symptoms of modern commercial life. If the horse is unequal to the constantly increasing demands which are made upon his energies in cities, there is, as his champion points out, always the refuge of the farm and cotton plantation. Pittsburg's destructive powers do not depreciate the value of motor vehicles which, it will be borne in mind, are especially constructed to contend against them.

FRENCH "RELIABILITY" TRIALS

SO many of the leading power wagon manufacturers of France were without representation at the "reliability" trials recently held in that country that the event may be considered as a failure from whatever point of view regarded. The products of but fourteen manufacturers were entered in the competition, including three firms which make tri-cars.

The competition, however imperfectly representative of the industry, at least had the merit of bringing forward a few features of structural equipment not hitherto observed. The growing use of pad tires was especially noticeable. At the trials held last year only two vehicles had these tires on their driving wheels. This year four were observed with all wheels so fitted. Four had the front wheels so shod, while two more had the rear wheels so equipped. In the case of two heavy trucks, these pad tires were of the two-track type on front wheels. The tendency is to place the rubber pads transversely, although the rubber blocks on the steering wheels of a 4-ton wagon were placed diagonally while those on its front wheels were placed transversely.

Electricity and steam were unrepresented at the trials. Three vehicles designed to use alcohol as an alternative fuel were entered in the competition, the decision of the Paris General Omnibus Company to employ engines of this character in its motor bus service largely accounting for the presence of these vehicles.

BREAKING IN GASOLINE CAB DRIVERS

EXPECTING that large numbers of gasoline motor cabs will soon be employed in London, many horse-cab companies employing a few motor vehicles are paying considerable attention to the training of their drivers for new duties. Almost every London motor cabman has been previously employed in driving a horse vehicle. Knowledge of the geography of the city, and experience in guiding a vehicle through its dense traffic, are very properly regarded as more important qualifications in applicants for positions than knowledge of motor mechanism. All that is expected of drivers is that they shall understand the common functions of the control parts.

As between two applicants for a position, one an abstainer from drink and the other lacking such virtue, the choice of the management invariably falls upon the former. Fully 50 per cent of the motor cab drivers in one establishment are total abstainers. All, however, are under pledge not to taste liquor while on duty. Classes are held daily for the benefit of the men. Once a week the manager of one company lectures his drivers on the functions of the gasoline engine, in addition to the regular class tuition.

It is noteworthy that despite their previous lack of experience the men soon become competent to take charge of the motor vehicles.

Drivers are paid a wage of $1.20 a day and 10 per cent on the gross earnings of the cab, which range from $8.50 to $15 per day, depending largely upon the location of the stand and conditions of the weather.

Rates of fare are as follows: One hour, $1.50; for each subsequent hour $1.20 (the rate of fare for horse drawn cabs is 50 cents per hour, speed not to exceed 4 miles an hour); for one-half day of five hours, $9.60; for whole day of ten hours, $16.80.

GERMAN GOVERNMENT NEEDS INFORMATION

INSTRUCTIONS have been given by the German government to all owners of commercial motor vehicles to declare the number in use and the purpose for which they are employed. The particulars will include the units of horse-power, nature of ownership, character of load, and other details.

DISCONNECTING BATTERY CELLS

THE best method of disconnecting cells assembled with pillar straps, for the purpose of replacing broken jars, cleaning or taking out of commission, is to use a five-eighths twist drill bit, in a carpenter's brace, boring down into the top of the pillar about one-fourth of an inch; then, pull off the connector sleeve from the pillar. By following this method, all parts may be used again. When cells are equipped with top straps, the straps should be cut with a sharp knife or chisel midway between the cells.

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Motor Fire Vehicles

Brigade Chief Draws Comparisons Which Are Decidedly to the Disadvantage of the Horse

EXPERTS now clearly recognize the economy which is to be derived from the substitution of motor vehicles for draft-animals in fire department stations of even the second and third rank.

The chief of a small brigade stationed in England, impressed with the superior advantages of the motor operated fire departments both in his own country and in Europe, recently verified the accuracy of the economies ascribed to them in the course of an interview with one of the largest producers of fire apparatus in the world, incidentally gaining information which led him to recommend his superiors to discard the horse service now in use. In his report, which includes the tables of comparative operating costs shown below, he points out that while the outlay for motor operated appliances would be almost two-thirds more than the outlay for horse drawn vehicles, yet it is to be borne in mind that this difference is more than compensated for by the reduced maintenance costs for a station equipped with motor vehicles. The first table of expense is based upon existing contracts for the hire of horses, but, as these contracts are not to be regarded as permanent, the fire chief declared that it was preferable to take the second table as an estimate for the comparison of expenditures. Each table provides for a fire escape and engine.

TABLE A

Initial Cost		Horses	Motor
Appliances, horsed	$3120	.....	.....
Capitalized at 10 years	.....	$384	.....
Appliances, motor	$8640	.....	.....
Capitalized at 10 years	.....	.....	$1080
Contract for hire of horses	.....	$1296	.....
Repairs to harness, etc.	.....	48	.....
Extra wages to motor drivers	.....	.....	240
Upkeep, oil, lubricating, tires, etc.	.....	.....	480
Annual expenditure		$1728	$1800

TABLE B

Initial Cost		Horses	Motor
Appliances, as above	.....	$384.00	$1080
Stabling for six horses, capitalized at 30 years	.....	$153.60	.....
Cost of horses, capitalized at six years	.....	$408.00	.....
Cost of harness, capitalized at ten years	.....	$ 43.20	.....
Keep of six horses	$1152	.....	.....
Less use for Council work	$ 576	$576.00	.....
Two coachmen and lad	$ 960	.....	.....
Less services in cleaning station and gear	$ 480	$480.00	.....
Wear and tear of harness, insurance of horses, etc.	$ 960	.....	.....
Two motor drivers	$ 720	.....	$ 240
Less services in cleaning and acting as firemen		$240.00	.....
Upkeep of motor, oil, tires, lubricating, etc.	.....	.....	$ 480
Annual expenditure		$2284.80	$1800

Neither of the above tables takes note of such items of ordinary expense as are common to motor and horse vehicle services.

Discussing the matter of comparative efficiency, the chief stated that there was no doubt of the superiority of the motor vehicles, which could leave the station without delay, travel with greater speed on the road, and especially show a valuable economy of time where horses were compelled to walk up steep gradients. Further than this, the swinging and skidding, so commonly observed in horse drawn fire engines, would be much less in evidence were the vehicles operated with motive power, as in the latter case the weight would be evenly distributed instead of the bulk of it being at the rear. Besides, no two horses could be relied upon to pull evenly, and the fore-carriage as a result was constantly moving out of a straight line and back again.

This observing officer even went the length of saying that, in winter weather, when roads were so frosty as to afford poor footing for horses, motor driven vehicles with special tire appliances could easily force their passage to any fire.

A still further advantage of the motor fire vehicle was the liberty it gave to drivers, upon reaching the scene of a fire, to act as firemen, whereas with horse drawn vehicles the drivers had to look after their horses. This meant that the employment of motor vehicles added two thoroughly expert men to the department force at the commencement of a fire.

Some one in authority at the conclusion of the report insinuated that horse drawn fire apparatus was more reliable than motor propelled apparatus. This chance remark gave the chief an opportunity to graphically describe some instances in which the utter unreliability of the horse in fire vehicle service had come to his notice.

THE RAILWAY INDEPENDENT UNIT

IT was the prophecy of a western railway contractor more than a year ago that "all the big steam engines on the standard railroads will be 'scrapped' and electric engines will be doing their work by 1925." Quite in line with this prediction are the words of President Baker, of the Master Car Builders' Association, now in session at Atlantic City, warning his hearers to be prepared for the rapid advance of the motor car in straight railroading.

It is one of the marvels of mechanical revolution that the steam locomotive, whose development by stages living men can still recall, is thus threatened just as it has reached apparently its perfection.

Toward the coming revolution in railroad operation both the trolley and the automobile have contributed.

Besides a demonstrated economy of operation, the motor cars will bring a very great advantage to standard railroads in competition with trolley circuits. They will make possible the running of frequent single cars, as "locals" in place of the occasional and slow "accommodation" trains. And in this benefit, as well as in the blessings of cleanliness and quieter running under the new order, the public will share.—*New York World.*

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City Motor Buses

Railway Authority Recognizes Their Usefulness as Auxiliaries to Existing Service

WITH railway authorities recognizing the usefulness of motor buses, and boldly recommending their employment in cities where monopoly's rule puts too severe a burden upon the population or traffic congestion urges caution in the granting of traction franchises, one realizes how near to universal adoption is the whole industrial motor vehicle movement.

A notable contribution to the literature on this subject recently appeared in the *Railway World*, of which the following is an abstract:

The day is dawning when the monopoly of transportation of passengers in the great cities of the United States will cease. The way is opening, too, for municipal ownership of transportation facilities, first in a small degree and then upon a more extensive scale as the plan is demonstrated by practical trial to be expedient and profitable. In such cities as New York, Philadelphia, Baltimore, Washington, Pittsburg and Chicago the passenger transportation lines are controlled by one corporation in each town. In some of the cities the surface street railways, the elevated and underground roads are combined in a single corporation, so as to make the monopoly complete; and in the eastern cities the franchises are perpetual, so that municipal ownership is impossible except at enormous cost, incurred by buying back at extravagant prices franchises which were freely given by their city. The difficulties which Chicago is experiencing illustrate fairly well the troubles which any city might incur in efforts to acquire the existing street railway lines. Those doors to municipal ownership of public service corporations are effectually barred.

But science has opened new methods of transportation. It is entirely feasible to operate lines of automobile omnibuses on all of the principal streets of a city. At small cost any city may inaugurate such a service on one of its highways. Without granting a franchise to any corporation a city may own and operate a line of automobiles. How well this plan works in the city of London is related by George R. Gaither, president of the second branch of city council of Baltimore, who recently made a study of the subject while in England. To a representative of the Baltimore Sun Mr. Gaither said:

"The motor buses, which are rapidly taking the place of the old omnibus in the center of London, are giving most satisfactory results, both in speed and economy. I understand from the reports of the companies that the motor buses have been a complete success. They are large enough to seat about 50 passengers inside and out, and the ease with which they are handled and the speed which they can attain in a short time have completely outdistanced the old system. The only criticism made by the companies was the wear and tear on rubber tires, but the latest reports show that the durable-tire question is already being successfully solved.

"In our own city I feel that by a proper application of our new $5,000,000 paving loan, having in view the ultimate development of this system of transportation, we could arrange to pave our thoroughfares so smoothly that a system of motor buses could be established and run with the greatest convenience and comfort to our citizens. If such can be accomplished, a municipal rapid-transit system could be established at a comparatively nominal cost, and the people obtain all the advantages of rapid transit and at the same time cheap fares and good service."

The motor-bus is destined to solve the vexatious problem of passenger transportation in large cities. It will not drive existing passenger railways out of business, but it will supplement them and relieve their over-taxed facilities. In the central parts of large cities all surface tracks are overcrowded with cars, so that it is utterly impossible for the trolley companies to increase their carrying capacity. Motor buses will relieve the pressure and take care of the surplus traffic. What American city will be first to adopt the new method and lead the way in municipal ownership and operation as well?

INTERESTING MOTOR BUS CONSTRUCTION

WITHIN a short time it is expected that 90 motor buses will be operating on the streets of Paris, orders for that number having been placed with manufacturers.

The vehicles possess many interesting features of construction. The four cylinder gasoline engine develops 40 hp. It is carried under the driver's seat. Side inspection shutters are provided, and the driver's seat may be removed bodily if desired. All the valves are placed on one side of the motor, the opposite side being left free for pump and magneto. The valves are super-imposed, inlet valves being above the exhaust. To ensure perfect lubrication for each piston, the lower half of the crankcase is divided into four separate chambers, thus giving a fixed level of oil, no matter what gradient is being climbed.

The engine can be run either on gasoline or alcohol, and it has finally been decided to employ this latter fuel for the Paris service. Ignition is by magneto and sparking plugs.

Solid rubber tires are fitted to all four wheels, and consist of two-track, diagonally-cut rubber blocks. The track of the front wheels is 55 inches, of the rear wheels 61 inches, and the wheel-base is 12 feet 7 inches. The empty bus weighs 9,614 pounds.

The vehicles are double decked, a 3 cent fare being charged for outside passengers and 6 cents for inside passengers—any distance.

MOTOR BUSES IN TEXAS

EARLY in July seven motor buses will be operated between Lubbock, Canyon City, Hale Center, Running Water and Tulia, in Texas, a trip which will require seven or eight hours for its completion. At first the state roads will be used, but eventually it is intended to make use of the Panhandle right of way across the plains, which will materially shorten the journey.

A motor bus line is to be operated from Carlsbad to Monument over the Guadeloup mountains in New Mexico. The vehicles will carry express and mail matter as well as passengers.

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Solidity of Roads

Second Article on the Importance of Good Roads for Heavy Motor Vehicle Traction

(By Lieut.-Col. G. Espitalier)

SOME of the difficulties to be vanquished with heavy traffic vehicles are internal. It is important to decrease and to deaden the jolting and vibrations which are due to the roughness of the road. These are augmented, even at a slow speed, by the heavy load placed upon each axle. Side-slip must be averted, for the frequent pranks of the motor car, and their effects, are the more dangerous as the car becomes heavier.

It is the tire which first receives the impact with an obstacle, whether projecting pavement, tramway rail, or anything else. The kind of tire is, then, most important; and we shall say a few words later on this subject. At all events the shock is transmitted with pitiless violence to the frame, thence to the motor and the ever delicate and complex parts inherent to the vehicle.

How to abate the violence of jolting? In the first place by a good system of suspension. The classical method of fixing springs in the axle and frame is not always sufficient. Good effects have been obtained by inserting checking devices, at least with ordinary motor cars—a kind of auxiliary spring which bends rapidly to yield to the jolt, always sudden, but which slowly returns to its position of rest, at least preventing any return shock on the frame. It is an improvement, but experience has not yet demonstrated its true value for heavy loads. The numerous forms of rubber-tired wheels are certainly based upon a judicious idea, though really they are only springs between tread and axle instead of between axle and frame. All this series of baffles can evidently give an appreciable result when the total load is slight, but is a defective remedy with the heavy loads we think of carrying.

The greater the load the stronger must be the springs. Consequently they only bend under great stresses and integrally absorb slight jolts which do not affect them to visible movement. What at first may seem singular is the fact that their efficacy is less as the car carries a lighter load. It is when running empty that it suffers most from jolts and vibrations. This can be understood, as the weight is not great enough to bend the springs, which are then like rigid bars without pliancy, and are consequently powerless to decrease any of the up and down movements of the frame. If the tire is such that the wheel jumps over the obstruction, springs alone cannot prevent a large part of this sudden change in the direction of their motion from finding its way to the frame.

The tire is the crucial point of automobilism in general, and of the heavy automobile in particular. The pneumatic tire suffices for light cars, because it at least does not jump at impact with a small pebble. It adapts itself to small irregularities of the road, and the road metal adheres to the rubber. In a word, obstructions only cause local deformations in this elastic hoop. But—and there is a but—the heavier the load the greater the difficulty in giving the pneumatic tire sufficient resistance. The limit seems to be already reached with large touring cars, and it is not easy to sustain a load of 1 1-2 tons on the axle, which is more than enough for an ordinary touring car, but too little for a wagon. Moreover, we must admit that such stout pneumatic tires are exceedingly expensive, and often burst, which increases the cost of commercial transport excessively without compensating benefit in the economy of traction due to the tire. Solid rubber has the advantage of not bursting, but is less pliant. Then, again, on ordinary macadam roads, always rather rough, many solid tires wear away in little shavings, which are left scattered about the road.

In the absence of anything better, wheels of heavy wagons should have the common iron tire, though on a bad road, paving stones, or contact with tramway lines, this unfortunate tire strikes the obstruction violently, and this tends to distort the frame. The mechanism vibrates, a jingle of iron is heard, and proper running of the vehicle—as also its life—is endangered. Wood, no doubt, might make a more docile intermediary, and run with smoothness and pliancy.

Long ago endeavors were made to utilize wood for the manufacture of tires. In 1850 Messrs. Cail put wooden tires on the wheels of a road engine, compressed in a cast-iron frame. The first Scotte trains were furnished with a similar device, and quite recently M. Soulas invented an ingenious wheel which has extensible spokes supporting the tire, so that there is no need to set up the felloes and spokes when the tire becomes elongated. Blocks of wood are fixed in regular steel sockets, which compress them and prevent their being crushed by lateral expansion, but this system is yet in the experimental stage. Messrs. De Dion-Bouton have also invented a tire formed of alternate plates of iron and wood, which rest on the ground like the edge of a book. Experience, alone, will show whether these different systems are free from the inconvenience associated with the first wooden tires, viz., slipping when the road is greasy or muddy.

Solid tires made with a number of rubber rings placed side by side have given good results on wood pavement; it remains to be ascertained whether they have not the same defects as others on macadamised roads. To sum up, the pneumatic tire bursts, solid rubber is cut to pieces, wood slips, and iron tires cause unduly rapid deterioration of the under-frame and mechanism, while the practical maximum speed is limited to about nine miles per hour.

Something must be done to nullify the effects of side-slip, for the lurches of a heavy wagon are more dangerous than those of a light car, and may cause irreparable mischief. Let it merely graze a humble cab and there is the tale of the iron pot and the clay pot—the cab is upset or smashed. Again, if it collides with the curb it

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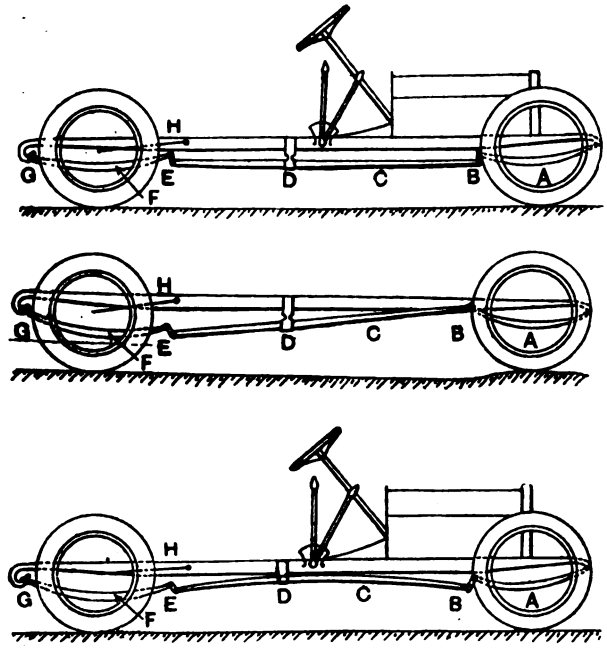
climbs on to it, and its momentum sends it through the window of the nearest shop, for the driver is powerless to control the caprices of the intractable monster. The embarrassment of a maker, when the question of selecting a tires arises, is demonstrated by the fact that, under the pretext that the front wheels are less loaded than the rear ones, the first often have pneumatic tires, while for the others it is found necessary to employ solid rubber, or even iron. This disproportion between the front and rear loads is not without inconvenience. In the first place, it limits the total weight, as an axle cannot be loaded beyond a certain limit, and, secondly, it causes a galloping movement in the vehicle.

This unequal loading is, nevertheless, justified in several ways: (a) it augments adherence of the driving wheels in the rear and prevents skidding; (b) it renders the steering more flexible; and (c) it protects the motor, carried in the front, from the too violent reactions of an excessively heavy frame. In fact, as the front axle is less loaded, it can be furnished with a more pliant spring, while in any event the jolts due to roughness of the road affect it less. Are the coefficients of adhesion so low that two-thirds of the load is required on the driving wheels? This does not seem to be an essential condition, because in the case of a traction engine we admit that it can haul twice the adhering weight. [With straked tires and larger diameters less than two-thirds is admissible.] In some racers, however, owing to the arrangements adopted with the driver's seat in the rear and all the heavy parts in front, it is the latter which is most loaded. The total weight for this type of car is fixed at 1,000 kilogrammes, empty, and this weight is usually distributed as follows: 600 kilogrammes in front and only 400 in the rear, and it is this adhering weight of 400 kilogrammes, slightly increased when the car is occupied, which suffices to move all. Thus we see that a heavily-loaded rear is not an essential. [A reduction is not possible with smooth iron tires, though with rubber no difficulties arise.]

(*To be continued.*)

TO REDUCE SHOCKS

IN order to distribute the effect of road shocks more widely throughout the structure of the wagon chassis it has been proposed, first in this country and latterly by two well known French engineers, to make use of a device which will permit the load to be carried more capably by each set of springs than is now customary. The suspen-



sion system herein illustrated provides great freedom of movement between the frame and the axles, and distributes the load in a constant and pre-determined manner.

Fig. 1 is a side elevation of a chassis with the suspension device in normal position. Fig. 2 demonstrates the operation and effect of the device when the steering wheels mount an obstruction. Fig. 3 shows an invert connecting spring.

The front axle is secured to the chassis by means of the springs A, of which the rear end is attached by shackles B to the balancing beam C fastened to the chassis so as to rock on and about the point D. The other extremity is, in its turn, attached similarly by shackles to the forward end of the rear spring F, which is also shackled to the rear dumb-irons at G. The radius rod is indicated by the line H, being its radial center. The oscillating point of the beam can be so placed as to accurately distribute the load between the two axles.

When one of the wheels encounters an obstacle, as in Fig. 2, the reaction is transferred by the intervention of the rocking beam to the other axle, the wheel or wheels attached to which are subjected to an opposite tendency which results in the frame being kept at its original level.

The balancing beam can be made in the form of an inverted spring as in Fig. 3, but still pivoted at D, so that the sensitive reciprocation of the system would be even more accentuated.

CART-HORSE PARADE

THE annual parade of cart-horses took place at Whitsuntide. There do not appear to have been any radical changes in design during the past year. All the animals are still fitted with four-legged propulsion, the reverse is harsh and jerky, and the braking power, as a general thing, is insufficient.—*Motor Traction.*

As it will be sometime before the Atlanta-Griffin and Interurban railway is completed in Georgia, an automobile passenger transportation company has been organized to afford service between the towns through which the railway eventually will pass. The motor bus service will commence on July 1.

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Pioneer Tri-Car

Vehicle put in Service Seven Years Ago but Abandoned on Account of Scarcity of Operators

SEVEN years ago the Pope Manufacturing Company built a commercial tri-car at its Hartford plant which is obviously today a vehicle of merit. Many machines of this type were constructed and for some time used quite extensively. Conditions, however, were adverse to the little vehicle, and after about a year its manufacture ceased.

The Hartford Electric Light Company permitted its lamp trimmers and inspectors to use these vehicles. They were also employed in one of the early motor package delivery services in Hartford.

Aside from its employment for commercial purposes the vehicle was used to transport passengers and mail collections. The machines were very popular.

The reason assigned for the abandonment of this seemingly efficient vehicle was the lack of competent operators. The drivers (the best obtainable at the time) required a long course of instruction, and largely on this account the service proved anything but a pecuniary success. The power plant was a 5 hp. single-cylinder air-cooled engine, with a water cooled head (the thermo-syphon system being employed for the latter purpose). A surface carburretor was used; ignition was by hot tube, although electricity later served the purpose; lubrication was accomplished by splash from the crank case; inlet valve was mechanically operated; and there were two speeds forward and one reverse.

The engine was started by a series of chains and sprockets, which were connected to the engine shaft and actuated by a pair of bicycle pedals. When the engine had acquired its speed the starting gear was automatically disengaged. Springs were full elliptic. Steering was effected by bicycle handle-bars which were secured to a long horizontal rod which engaged a series of bevel gears over the post of the forward wheel. Spark and throttle levers were arranged in convenient positions before the driver, as was the clutch.

Sufficient gasoline for 75 miles was carried. The load capacity of the vehicle was about 600 pounds. Four persons and the operator were usually carried in passenger service. A speed of fifteen miles an hour was possible under ordinary conditions. Such a vehicle is today in demand among many establishments distributing light merchandise. Its speed, radius of action and reliability are better appreciated now than they were seven years ago. Besides skilled operators are plentiful.

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Their Attention

AN experienced man will come across a car in which he finds it practically impossible to get his first speed or reverse into mesh without grating, though other gears seem to go in quite noiselessly. The reason for this is generally to be found in the clutch, the driven member continuing to rotate after the clutch has been withdrawn. Thus, when starting from a standstill, as soon as the clutch pedal has been depressed the driver attempts to engage his first speed or reverse while the first motion shaft is still spinning. This means engaging a rotating spur wheel with a stationary one, and consequent noise. When the second and third speeds are engaged both shafts are rotating, and consequently engagement is easier, and there is little or no noise. If this grating of gears occurs and is not attended to it will result in the first speed being worn out rapidly. There are two or three causes for the clutch's continued rotation, one of these being lack of lubrication.

TO START AN ENGINE EASILY

Novices have difficulty in starting up their engines. They are often afraid to stop the engine while leaving the wagon for a few minutes, on account of difficulties on restarting. In most cases starting is quite easy if care is taken to always close the additional air inlet and open the throttle fully. If necessary, the curburetter should be flooded slightly. This should be done, not by lifting the needle valve or by holding down the plunger, but by lifting and depressing it sharply, so as to spray the gasoline from the jet right up the induction pipe. This coats the walls of the pipe with gasoline, and a firing mixture is taken into the engine at once, no matter how slowly it is turned over. Excessive flooding should always be avoided, as it is rarely, if ever, successful in getting the engine under way. A good tip to facilitate starting is to open the throttle wide and close the air inlet just before switching off, so that the cylinders and induction pipe are filled with a rich mixture, ready for the first spark on turning the engine over. Make a point of starting up with the left hand, so that in the event of a back kick the right hand gets off scot free.

CAUSE OF PREIGNITION

Preignition of the engine is a fault that is apt to deceive the novice at driving for some little time. While caused directly by something easily remedied, it is no light matter to get at the seat of the trouble before operations can be undertaken. The root of the trouble is to be found in a continued excess of lubricating oil or of the wrong kind of oil, probably the latter. This works its way into the combustion chamber and becomes carbonized. The greater proportion of it is blown out at the exhaust valve, but the small percentage that remains is more than sufficient to cause the wagon to be laid up in time. This small amount falls back and becomes attached to the top of the piston. Gradual accretions not alone strengthen its hold on the metal, but increase its size. Having got into this condition the trouble develops when the engine is allowed to run hot for a short time. As the engine becomes hotter the preignition becomes earlier and earlier, until with an alarming pounding as a preliminary it finally brings the engine to a stop. Any attempt to restart before permitting things to cool will result in a nasty back-kick, even with the electric current switched off. A certain test of this state of affairs is to shut off the spark while the motor is running; if the investigator's suspicions are to be confirmed the engine will continue to perform just as if nothing had happened except that it will not develop any power under load.

THE FITTING OF VALVE SPRINGS TO SPINDLES

It is extraordinary how frequently one sees the average mechanic struggling and sweating with a spanner end or a screwdriver to lift the valve spring of a mechanically-actuated valve by leverage, with the point of the instrument against the smooth wall of the cylinder, in order to attach the cup and cotter to the valve spindle. He may succeed after a time, but it is always at the expense of time, temper, and knuckle skin. Very few appear to be aware of the trick of compressing the spring and tying it up in its compressed form with string, so that it is slipped over the valve stem, the cup and cotter placed in position, and then, the string being cut, there is the spring in position without any more fuss.

HISSING NOISES

Hissing and puffing sounds are generally somewhat difficult to locate. If a compression tap falls open, the noise resulting is a sharp crackling hiss, accompanied by loss of power, which is easily remedied. A further cause, which might result in considerable damage being done, and which is very difficult to locate, is that of an open, or lost, oil drain-tap in the crank chamber. As this is generally out of sight, it is similarly out of mind, and in consequence a driver may continue on his way until he is stopped by a binding piston. A blown exhaust pipe joint, or loosened nuts on the exhaust system, is usually accompanied by a sharp hissing or crackling, and can generally be put right in a few minutes.

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Keep Track of Mileage and Speed

It is fully as important to register the distance traversed by a power wagon as it is to have a record of the fuel or electricity consumed, or the quantity of lubricant used. The mileage of the vehicle is most accurately registered by a *VEEDER ODOMETER*. If a record of both speed and mileage is required the employment of a *VEEDER TACHODOMETER* becomes imperative. Descriptive literature of these instruments sent upon request.

Veeder Mfg. Co., Hartford, Conn.

William P. Kennedy
Consulting Engineer

Commercial Automobile Design and Equipment *Garage and Power Plant Equipment*

1765 BROADWAY, NEW YORK

AN EXTENSIVE CAB SERVICE

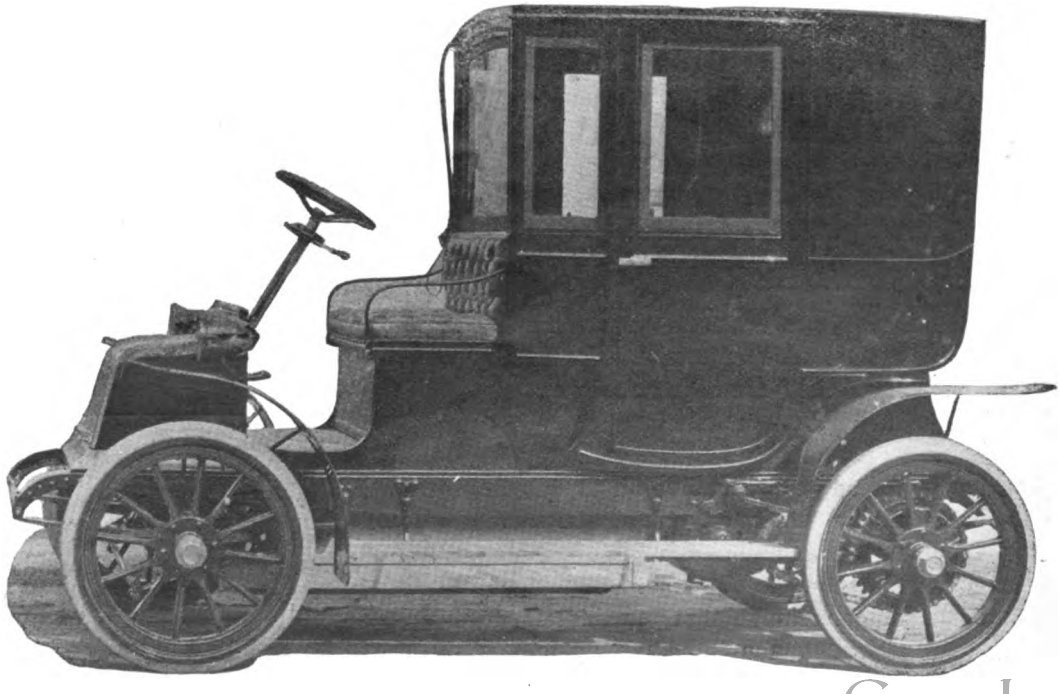
ONE hundred electric broughams like that illustrated below will soon be seen on the streets of New York. Already the New York Transportation Company employs 50 such vehicles, but recently ordered 50 more.

This company now has almost 600 electric vehicles in public service, as well as 18 gasoline touring cars. The following table shows the nature of the vehicles employed:

Hansom cabs	202
Broughams, end loading	159
Broughams, underslung batteries	90
Victorias	40
Convertible brougham-victorias	26
Landaulets	25
Two-seated surreys	23
Opera 'buses	11
Three and four-seated surreys	10
Delivery wagons and trucks	7
Emergency repair wagons	3
Touring cars	18
Total	614

The company employs about 350 drivers, 50 battery caretakers, 86 mechanics and 122 general utility men.

Drivers are paid only for the time actually spent in operating the vehicles. Monthly and weekly rentals form a large part of the company's business. Rates for monthly service vary from $275 for a motor hansom to $350 for a landaulet, with maximum mileage placed at 650 miles. Weekly rental rates vary from $80 to $125, with mileage limited to 150 miles. Excess travel is charged for at the rate of 30 cents a mile.



New Type of Public Electric Brougham used in New York City.

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WALTER WARDROP, EDITOR AND PUBLISHER

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Edison's Prophecies

Mischievous Character of "The Wizard's" Attempt to Discredit Existing Electric Vehicle Construction

ALTHOUGH professing to harbor none but the kindliest feelings toward the electric vehicle industry Thomas A. Edison contrives to stab it oftener than the most malicious of its enemies. Assisted by a band of chroniclers of industrial small talk he manages to keep the public constantly keyed to a high pitch of expectancy concerning the extraordinary importance of an invention which is forever impending and of which he is ever on the verge of presenting to the world. A policy so malicious causes dissatisfaction with the vehicles we already have, detracts from their worth, and makes it appear that purchasers would be acting imprudently if they did not wait for the appearance of his featherweight storage battery.

Whether the rumors which have been current for years concerning "the Wizard's" improvements are to be regarded as expressing his genuine convictions, or are merely the vaporings of his reportorial allies, is difficult to say, but wherever the blame is to be placed it is certain that an important arm of the automobile industry has been much maligned, much retarded and much damaged by Mr. Edison and his scribbling consorts.

An exasperating feature which invariably accompanies an Edison interview is the precision of the terms in which the inventor is made to speak. We learn, for example, that by the use of cobalt storage batteries the cost of moving city merchandise is to be lessened exactly 55 per cent. What methods are employed to reach this conclusion deponents sayeth not. Like much else in these far flung interviews the imagination of readers is expected to complement the extravagant statements of "the Wizard" or his Boswells. The almost infinite variety of transportation coupled with the shifting conditions which affect cost, would deter even an amateur actuarian from venturing a speculation so hazardous.

Many of Mr. Edison's inventions have been of undoubted service to mankind, but the history of his activities, taken in the large, does not seem to vary very much from what we are accustomed to find in men of like mental endowment. He errs with frequency; he indulges in great dreams; he attempts many things which circumstances over which he has no control compel him to abandon, but which nevertheless are exploited with great vigor by capable people having special ends to serve, or by capricious reporters who make a professional study of the art of misrepresentation.

Three years ago Mr. Edison was to present to an expectant world the fine fruit of his thought on the subject of nickel-iron storage batteries. Manufacturers prepared to make use of them. The public grew to believe that 100 mile journeys in electric vehicles would be as common as similarly lengthy excursions in a gasoline or steam vehicle. Purchasers of all kinds of automobiles paused until Mr. Edison could bring this triumph of his genius into the world. It may be here already for all the automobile industry knows to the contrary; indeed, it is well established that a few vehicles have been equipped with the device. A great many well informed people, however, assert that it has been a rank failure from the point of view that it has failed to give the service expected of it, and is in no wise superior to the lead storage battery now commonly used. Meanwhile Mr. Edison has discovered a ledge of cobalt as thick as a county, and quietly lets it be known that with this as an

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agent to subdue the other refractory ores, he is once again on the high road to the discovery of the perfect storage battery.

Mr. Edison's dominant characteristic is his optimism. Such optimism, however, in the face of repeated disappointments, excites quite a contrary feeling in the public and particularly in merchants who have capital and hopes invested in products which Mr. Edison indirectly derides, but which, despite the labor and research of years, he seems incapable of improving.

The facts in the matter are these: The electric wagon equipped with lead batteries performs the work expected of it economically and regularly. If its mileage radius was increased, as Mr. Edison has often threatened, by 50 per cent, it is barely possible there would be a little more work for its increased capacity than we witness today.

While Mr. Edison is preparing to anticipate the wants of the future in the matter of a light storage battery with large traveling radius, it is noticeable that many of the shrewdest merchants in the country, not expecting to live until all of Mr. Edison's prophecies come true, are making available the means at their command. This is but the sign of wisdom, for to refrain from making use of an article until its development was brought to the highest pitch imaginable would deprive the world of many of the most useful auxiliaries of civilization.

Power Wagon Trials

Showy Events Which Fail to Demonstrate the Chief Characteristics of Motor Vehicles

AN active minded correspondent at the Capitol informs us that the war department has decided to make "a thorough test of the automobile as a means of military transport" in the course of the mobilization exercises to be held this summer. Then, as if to give flavor of novelty to the statement it is said that three touring cars and a power wagon, the latter not yet emerged from the experimental condition, are to be used by the commanding general in the maneuvers.

It does not particularly concern the readers of this paper to know what end the war authorities have in view in "testing" touring cars. Probably the board of strategy wishes to ascertain if they can be driven over dirt roads. Speculation upon the subject is necessarily vague. The experiments to be made with the power wagon, however, will execute keen interest, particularly if the vehicle proves to have been designed for some special branch of military transport work. But if a wagon such as is to be seen every day in commercial service is merely transplanted to the scene of mimic warfare, and put to the trivial duty of hauling a few boxes of ammunition or other military stores, the "tests" will conclude with little more knowledge available than may be had at the present moment by merely inquiring of merchants.

It will be interesting to watch the thoroughness with which the war authorities conduct this "test." One cannot help wondering if they will coach the manufacturer of the vehicle which is to be exploited, or whether they will leave him to his own devices.

There is this marked difference between the trials of military motor wagons about to be conducted in this country and those which have taken place abroad. Here manufacturers get the ear of some one high in governmental life, from whom permission is obtained to make a demonstration, which is in camera so far as the public is concerned. Abroad the method of proceedure is quite the opposite, for manufacturers are invited to submit designs to certain governmental specifications, and the trials have all the symptoms of a competitive test.

From what is known of the forthcoming trials it does not appear that any power but gasoline will be considered; whether the wagons will be of 1, 2, 5 or 10-ton capacity is not stated.

* * *

So far as can be observed the Automobile Club of America is receiving but scant encouragement from manufacturers to proceed with its plan for conducting public trials of industrial motor vehicles in the fall. The barrenness of such exercises, the difficulty of investing them with any but the mildest interest for the commercial classes, and the known incompetence of those at the head of the enterprise, seem to have chilled whatever enthusiasm was aroused by the first semi-official announcement of the meddlesome organization.

The prevailing impression in trade circles seems to be that the club lacks the experience required to formulate governing conditions which would prevent the spectacle from becoming farcical. There appears, however, to be an undercurrent of opinion that if a trade association, composed of experts in practice and thought attending the employment of power wagons, was to take the matter in charge some enlightening information could be elicited. Repetition of the crude and clumsily conducted experiments to which manufacturers have submitted in the past will hardly be encouraged.

Judging from the pages of the foreign papers just come to hand nothing of the slightest interest to merchants using or contemplating the use of motor wagons was disclosed at the trials recently held in France.

The dullness of the printed stories, which occupy many pages and are profusely illustrated for the purpose of concealing the lack of reliable information, is all the

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more remarkable on account of the fact that opportunity for making it enlivening was not wholly wanting. Nobody knows whether the work of the vehicles was superlative or inferior because there was nothing with which to contrast their performances. Apparently the only object in view was to demonstrate that while fuel lasted and structural parts held together vehicles could be operated for a couple of hundred miles on carefully selected highways. There is nothing in the written history of the trials to suggest that the thousands of vehicles already employed in commercial service possess any value except as experiments. Past commercial experience was utterly disregarded.

Motor buses, for example, which are used by the thousand in Great Britain and Europe, were sent to the starting mark day after day for a week and not given as much road work as a London bus performs in the course of 48 hours. To demonstrate what? Not their reliability or plain utility, for the millions invested in them would indicate that these qualities are accepted as proven. It was thus, too, with other types of commercial vehicles. The trials were wholly devoid of commercial significance.

Of course they developed a speculative interest in the durability of the machine. The durability of a motor wagon, however, is not determined by any brief manipulation by an expert driver, but rather by the care and skill which a comparatively ignorant driver exercises while having it in charge.

The great harm of these "trials" is that they shake public confidence in the demonstrated qualities of the machine, leaving it to be inferred that so much ceremony would not be necessary if the boasted advantages of the power wagon were actually proven.

JERSEY MOTOR BUS SERVICE

THE East Jersey Motor & Transportation Co., capitalized at $100,000, has commenced its motor bus service between Elizabeth and Rahway. Six vehicles have been purchased. The cars start at half hour intervals from regular stations at Elizabeth and Rahway, and on the route run through Roosevelt (formerly Carteret), Woodbridge, Boynton Beach, Sewaren and Port Reading. This entire section has hitherto been without adequate passenger transportation facilities.

Caterer's Delivery Wagon

THE economy of an electric wagon, like the one shown above, when the vehicle is well adapted to its work, has been demonstrated so often as to make reiteration of it somewhat tedious. The record of a Pittsburg wagon, however, employed in the service of a caterer in that city, was so surprising economically as to almost make experienced investigators doubt the accuracy of the figures which were submitted in verification of it. The wagon in question, purchased at a cost of $2,500, actually performed the work of four horse-drawn wagons, thus affecting a saving in labor alone of about $200 per month, a driver and boy being employed on each of the horse wagons at a weekly wage of $12 and $5 respectively. It is claimed by the owner of this wagon, whose experience with draft animal service is not inconsiderable, that the charges for electrical current and minor repairs during the first six months were not nearly so great as the expense which would have been incurred in stabling the horses and wagons which the motor wagon superseded; so that to the economy in wages alone, there is to be added whatever gain is thus represented. The owner further calculated that by the time battery overhauling and plate replacements would be necessary, he would have saved sufficient money to pay for these necessary expenses and still have a handsome surplus; in fact he reckoned that at the end of two years the wagon will have paid for itself.

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Studied Misrepresentation

Futile Attempt to Show That the Adams Express Co. is About to Abandon Electric Vehicles

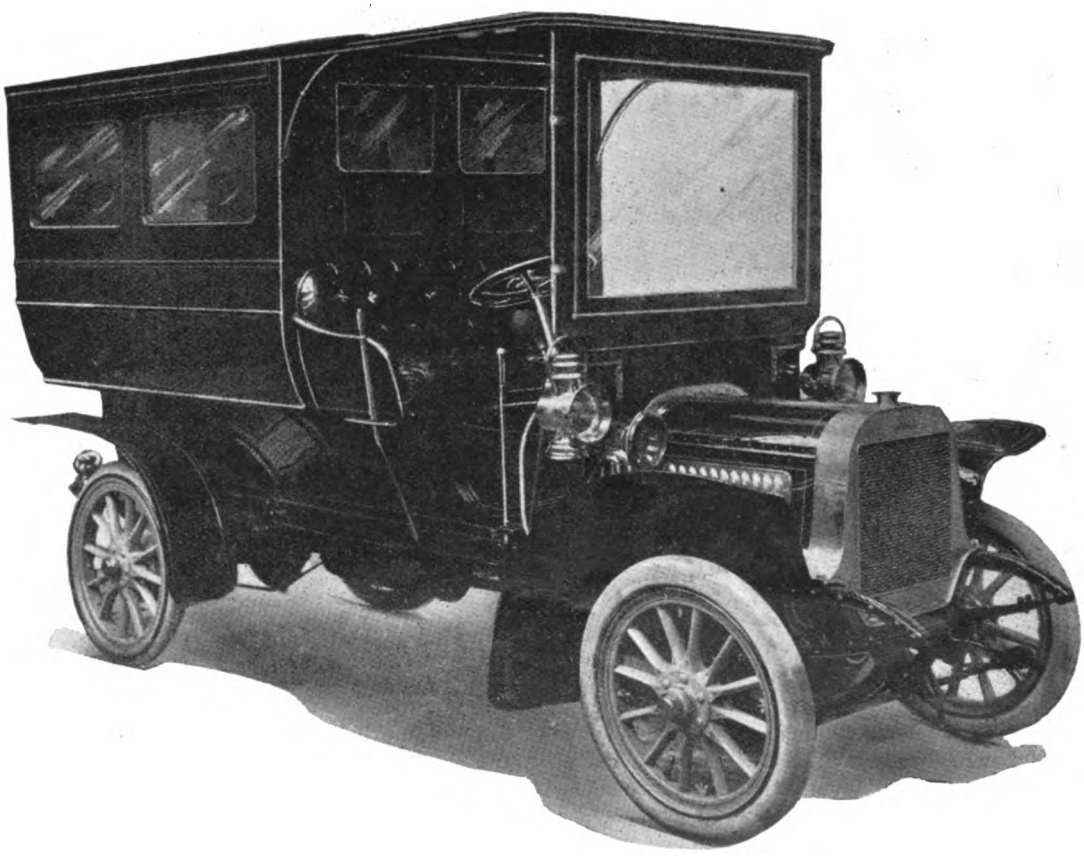
TO a blind horse a nod is as good as a wink. To an obtuse human a smile in response to a question is confirmation strong as Holy Writ of an opinion sought to be elicited.

Not long ago a representative of a paper which is notorious for the blunders it has committed on the subject of electric motor vehicle traction, got wind of the none too well guarded intention of the Adams Express Company to dispose of some of its electric wagons and, concluding that the company was about to wholly abandon this type of machine, immediately set to work to write a story which would in every way match the desires of the proprietor of the publication.

Now officials of the express company are always scrupulously careful about discussing their private affairs with people who have no deep concern in them. Naturally, therefore, when the interviewer asked point blank if the company intended to dispose of all of its electric vehicles, a smile was the only response. This smile was described as darkly significant. The interview represented the reporter as describing a situation he evidently desired to bring about, and the official of the transportation company as smilingly assenting to all the other said.

Not one word of confirmation, however, came from the company official's lips, and for the very excellent reason that the Adams Express Company, so far as those in its confidence are aware, has not the slightest intention of abandoning a type of wagon which for a number of years past has afforded excellent satisfaction in service and an economy beyond the ability of any to contradict.

There was, however, some slight foundation for the suspicion of the interviewer. It has been known for some time past among those who take more than casual interest in the development and use of the power wagon that the work of the Adams Express Company is not of such a nature as to call for the excessive structural weight which characterizes the vehicles they have been making use of in the past. Experience has taught the company that it is undesirable to employ power wagons with a greater carrying capacity than 1,500 or 2,000 lbs. Their old wagons are big enough and heavy enough to carry 2 tons, axles, frames and other parts being much heavier



Traveling Salesmen's Cab

CABS of the type shown in the above illustration are extensively employed abroad. The vehicle is well adapted to carry samples. It is chiefly employed in city service, although in districts where the population is dense the traveling radius of the vehicle enables the salesman to call upon customers without any unnecessary expenditure of time and more economically than if he trusted to railways for the transportation of himself and his merchandise. The vehicles are usually fitted with a gasoline engine of 15 hp. and channel steel frame.

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than in the new vehicles for which they have given such liberal orders.

The company now has in its Washington, Rochester and New York service many vehicles weighing from 5,200 to 5,500 lbs., with a carrying capacity of less than 2,500 lbs. It is their desire to get rid of these heavy vehicles upon as advantageous terms as possible and in their place put new vehicles which will weigh about 3,200 lbs. and have a carrying capacity of about 1,500 lbs. In structure, weight and carrying capacity the old vehicles are wholly unsuited for the business of the company. Naturally it has taken some time to discover this important fact, as the cost of maintenance and other items of accounting, powerfully affected by service conditions, could not have been apparent at the beginning.

Further than this, the company has several types of vehicles, acquired during its early experiments with the power wagon, which, now that official judgment concerning the type best adapted for express service has become crystallized, are not looked upon with much favor. These are to be discarded.

There is still another reason which urges the company to get rid of all its old vehicles. With customary prudence it desires to standardize all its purchases, not wishing to be bothered by having to buy separate parts for vehicles which manufacturers are no longer producing.

Readers of this paper are familiar with the belief of the Adams Express Company in the suitability of electric vehicles for much of their work in large cities through the recent announcement of its purchase of 150 wagons from two eastern manufacturing establishments. We anticipate, however, that they are not so familiar with the experience which the company has had with the old wagons which it expects to sell. It is stated with frequency and emphasis in transportation circles that no type of delivery in the world is so cheaply conducted as that of the Adams Express Company in Buffalo, where nothing but electric wagons are employed. The efficiency of this service is something to marvel at. This is largely owing to the capable administrative supervision of the gentleman having charge of the service and whose efforts, it is reported, are so highly appreciated by his employers that he is to be given complete charge of the company's power wagon installations wherever located, and entrusted with the special duty of bringing them all up to the same efficiency as that which distinguishes the Buffalo service.

MOTOR TRUCKING COMPANY

WITH a capital stock of $100,000 the Turner Motor Transfer and Trucking Company has been chartered to do business in the city of New York. The company's wagons will be in active operation in a very short time.

The plans of the company are set forth in the prospectus which it has issued. From this document it appears that the company has been formed "for the purpose of acquiring a number of motor trucks ranging in price from $1,200 to $2,500, hiring drivers at $18 per week, and a machinist at $35 a week to superintend repairs; to rent the vehicles by the year at from $2,500 for the service of a 1 1-2 ton truck to $4,000 for a 2 1-2 ton truck," keeping three wagons in reserve to remedy whatever interruptions may occur in service while the vehicles are on the road.

The company's contract with its customers reads as follows:

"The Turner Motor Transfer and Trucking Company agrees to furnish one motor truck, complete model, with capacity sufficient to do the work hereafter agreed upon, with a speed to be hereafter agreed upon, and capable of performing the business for which it is required; and it also agrees to furnish said motor truck for your use at your place of business every week day during your business hours, as you may require, with one driver, to deliver your merchandise upon the following terms, to wit."

Both gasoline and electric trucks will be employed in the service of the company. A well equipped garage will be established with suitable facilities for making repairs, charging, etc. The company is evidently aware that success in its enterprise depends largely upon the care which is exercised in the maintenance of the vehicles. Assistance to disabled vehicles will be rendered by the company's men mounted on motor cycles or else by the crew of the company's repair wagon.

MILITARY MOTOR SEARCHLIGHT

A PORTABLE searchlight equipment is now being tested by the army authorities in England. The chassis of the vehicle on which it is mounted is 18 feet long. On its platform is a 45 hp. gasoline engine, with high and low tension magneto ignition, which is coupled direct to a multi-polar dynamo for generating the electricity for the searchlight, which gives 40,000 candlepower.

The vehicle itself is propelled by a 20 hp. engine, giving a speed of about eighteen miles an hour. Solid tires are fitted. The time taken for stopping the engine and showing the searchlight is said not to exceed a minute. Three men only are necessary to work the whole affair, but accommodation for four and the driver is provided. There is practically no vibration. A canopy covers the car entirely, but this is removable at will. The vehicle can run for 100 miles, and the light be shown for ten consecutive hours without any necessity for stopping for fuel supplies.

HORSES SOLD TO MAKE ROOM FOR MOTORS

FOUR hundred horses and 40 horse drawn buses were recently disposed of by a London horse omnibus concern which is taking active steps to employ motor vehicles. The time is fast approaching when a horse drawn omnibus in London will be looked upon as a curiosity.

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Testing Fire Vehicles

Berlin Appropriates $12,500 in Order to Ascertain the Value of Automobile Construction

LAST March the city of Berlin appropriated $12,500 for the purpose of testing the value of self-propelled fire brigade vehicles. In the course of the report urging the appropriation the following interesting observations occur:

"The advantages of using automobiles for fire-extinguishing work consist particularly in the very material saving in the costs of working and maintenance. In short, through the use of automobiles, the work at the stations becomes much simpler, an alarm evokes a readier response, and the vehicles reach the place of the fire—especially when remote—sooner than the horse drawn class. Hanover was the first German city to employ automobiles for fire-brigade purposes. In 1902 three vehicles were placed in the service. They answered capitally, and, furthermore, what was the chief consideration, proved far cheaper. Their maintenance cost but $500 a year, whereas the up-keep of the horse drawn service involved an expenditure of some $3,000.

"But what does for Hanover and other middle-sized cities cannot be applied off-hand to Berlin. In regard to street traffic, number of calls, and distances to be covered by the vehicles of the fire brigade, the conditions in Berlin are totally different from those in other German cities. The construction of automobiles must be adapted exactly to prevailing local conditions. Hence, for Berlin, trial vehicles must be newly constructed and thoroughly tested.

"Since with the fire brigade it is primarily a question of absolute reliability and promptness of working, and since, further, the ponderous engines and escapes must travel at a fast pace and among heavy traffic, the internal-combustion motor, of which very unfavorable experiences have been had in Vienna and Paris, cannot be entertained as a means of propulsion. On the other hand, electric and steam motors have answered well. Electromotors possess the great advantage of being able to get under way at once in case of a call, and experience shows that they are more reliable in working than the internal-combustion motors, while the steam vehicle is more efficient than either.

"Trials will accordingly be made in Berlin with an electromotor and a steam automobile. The trial runs are to be carried out daily until each vehicle shall have covered 10,000 kilometers (6,214 miles). Should the experiments turn out favorably, proposals will be made to acquire for station No. 4, which must be equipped in 1907, a complete automobile service. Definite plans respecting the gradual conversion of the horse drawn service into a motor service cannot be made at present, yet it may be now pointed out that, for such a conversion, the sum of $73,440 is available. The horsing of the Berlin Fire Brigade costs this sum every year."

MOTOR CABS

BETWEEN 11,000 and 12,000 horse drawn cabs now ply the streets of London. For some time past it has been conjectured that their service would eventually be supplanted by motor cabs operated by companies which control the motor bus business.

The managing director of London's largest motor bus company, however, recently stated that in all probability the horse cab companies would themselves control the motor cab business of the metropolis, implying that the motor bus companies had quite enough to do to care for their own special form of traffic.

He asserts that it will be three, or perhaps four, years before the horse drawn omnibus will disappear from the streets of London, owing, not to any lack of desire for their suppression by motor vehicles, but to the slowness in procuring modern vehicles or their parts from manufacturing establishments.

MOTOR VEHICLE FINANCE ABROAD

DURING the month of May no less a sum than $5,136,00 was added to the already large capital invested in British enterprises formed almost exclusively for the purpose of operating public service passenger motor vehicles. This sum is in addition to the $6,000,000 which has been invested by concerns employing, or about to employ, motor buses, cabs and other vehicles intended for public transportation. It takes no account whatever of the investments of merchants and others who are buying liberally from concerns which are manufacturing motor wagons for merchandise delivery.

A list of the enterprises for which fresh capital was subscribed in May is appended:

	Authorized Capital	Amount Offered
Anglo-French Herald Motor Co.	$ 576,000	$ 360,000
Alliance Motor Bus Co.	960,000	480,000
Beaufort Motor Co.	720,000	240,000
General Motor Cab Co.	1,248,000	1,104,000
*Great Eastern London Motor Omnibus Co.	1,944,000	1,440,000
Gearless Motor Omnibus Co.	1,056,000	1,032,000
London Road Car Co.	480,000	480,000
*Further issue of capital	$6,984,000	$5,136,000

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A Foolish Criticism

Contrasting a Trivial Advantage of Horses With an Apparent Shortcoming of Motor Wagons

THE superintendent of delivery in a large Washington store entertains the opinion that there is little economy, so far as time is concerned, to be derived from the substitution of an electric wagon for a horse drawn vehicle. He supports this opinion by the following statement:

"The driver of a horse wagon will leave his seat and be half way up the steps of a house before the horse has come to a stop. Returning, he calls to the horse, which starts as he comes out of the gate and has gone from 10 to 20 feet by the time the driver reaches his seat. With the electric wagon, of course, a man does not leave his seat until the wagon has come to a full stop, and he does not start the wagon again until he is seated. Multiply this slight saving in time by a hundred or two hundred stops and you have the reason why the increased speed of the electric wagon does not make a showing against the horse wagon."

Statements of this kind are well calculated to beguile the unwary. They seem to have all the characteristics of truthfulness, while, as a matter of fact, being strictly imaginative. The horse which will move to the call of its driver is usually a brute with about as much speed as a crab, and probably would be exhausted at the end of a 10-mile journey. Granting, however, that twenty feet is gained every time the horse vehicle is started, the total gain for two hundred stops would amount to about 1,300 yards, which distance it would take the electric vehicle about three minutes to cover if it moved at a rate of 15 miles an hour. Such a trivial advantage in the course of a day's service is not worth fussing about.

The prejudice or ignorance of this critic did not permit him to consider the superior carrying capacity of the motor vehicle.

Only foolish and inexperienced people imagine that one electric vehicle will economically do the work of one horse drawn vehicle, particularly in service where stops are very frequent. Such services, however, are comparatively rare.

Some people make the error of imagining that power wagons are adapted to all classes of commercial service, regardless of governing conditions. The case under consideration affords an excellent opportunity for pointing out the indispensable conditions for power wagons in general. They must be well adapted to the particular service in which they are employed in order to show the economies which are claimed for them. A power wagon, for example, would make a poor showing delivering milk from house to house. The conditions of such a service would be almost identical with those prevailing in the business of the Weshington store above referred to. Neither the superior carrying capacity, nor the speed of the motor vehicle could be made manifest in work of this sort.

The superior braking of the power wagon is also overlooked by its Washington critic. If it is necessary for the driver to remain in his seat until the vehicle is motionless this disadvantage is more than offset by the rapidity with which it can be eased from fast speed to a full stop. Besides it can get under way quicker than a horse.

Twice as Efficient as Draft Animals

FOR some time past the United States Stamped Envelope Works at Hartford has employed a 5-ton electric wagon. The vehicle, which operates the year around, is shown in the above illustration. It averages about 25 miles a day. The hauls are short, not over a quarter of a mile in length. The route traversed is over a good roadway. The charging of batteries is done on the company's premises. The vehicle accomplishes about twice as much work as the 2-horse team which was employed prior to its installation.

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The Life of a Wagon

Vehicle in Semi-Commercial Service Which Indicates the Durability of Light Motor Wagons

NOBODY definitely knows how long a light electric motor wagon may be run if it is given intelligent care in the stable and not abused on the road. Certainly if it is confined to the service for which it was designed, and is not overloaded or operated in a careless manner, it should make as good a showing as a semi-commercial vehicle of the kind used by physicians in good practice, particularly if the tire equipment of each vehicle, mileage, speed and other factors necessary for comparison, are substantially alike.

There is a runabout in Hartford, Conn., which, although in active use for seven years, is still regarded by its owner, Dr. G. Reinert, as a highly efficient vehicle. In all that time it has been maintained at a cost of less than $400 exclusive of cost of charging. It weighs about as much as a modern light delivery wagon having a carrying capacity of, say, 800 lbs. Its duty almost exactly corresponds to the service expected of such a light commercial vehicle. Its speed is relatively low, its daily mileage is not excessive, and its journeys are regularly performed.

The only advantage it has over a motor wagon lies in the careful supervision which its owner gives to the battery and mechanism, a care which is abundantly rewarded in the form of a very remarkable economy.

Under the practice of periodically renewing batteries, repairing tires and close inspection, the cost of maintaining this vehicle has long ago reached the point where, barring accident, its upkeep can annually be known in advance. In other words, the average of maintenance has been found, and there is likely to be little variation from it so long as the motor continues to perform its work; and given ordinary care, the motor should outlast the doctor.

The story of this singularly interesting little vehicle is thus told by a correspondent:

"Dr. Reinert has for the past seven years operated an electric runabout at a cost of less than $400. During this time the vehicle has been in constant service at all seasons of the year, day and night. The rear tires are of the solid rubber endless variety, which have been once repaired at a cost of $20. The front tires, also of solid rubber, have caused an expenditure of but 25 cents in the past sixteen months. Good luck may in a measure account for this remarkable success with tires. Still the doctor in his travels has no time to pick out bad spots in the road, but takes them as they come.

"When first purchased this machine was fitted with wooden wheels at a cost of $150. The body has been repainted once at a cost of about $75. Battery supplies have cost $100. The negative plates originally fitted to the machine are still serviceable.

"The doctor makes his own batteries, which are of 44 cell, chloride, and these he washes three times a year.

"The steering mechanism is as firm and positive today as when the vehicle was first purchased. No trouble has been experienced with the motor or wiring system. Repairs, due to breakage, have been trivial. Batteries

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are charged through a rheostat from direct current of 110 volts in the doctor's own stable.

"The operation of this vehicle is as noiseless as a modern machine. An average speed of 12 miles an hour is obtained.

"Every morning before starting on his round of duty the doctor makes a careful examination of the machine, giving it that attention which custom and experience has taught him it is necessary to give the human mechanism which, though deranged, may exhibit no visible symptoms of the disorder. To this thorough matutinal inspection he wholly ascribes the unfailing regularity with which the vehicle performs its work.

"Of course the service of such a carefully kept machine yields a big economy. In illustration of its commercial advantages the doctor points to the experience of a fellow physician who during the past four years has exhausted four horses, costing on an average of $250 apiece, and worn out three buggies which cost $200 apiece. Add to the sum of these items, which amounts to $1,600, the cost of feed, shoeing and repairs and it becomes plain that the doctor using the electric vehicle is considerably ahead of his brother who uses horses."

The useful life of some gasoline cars, such, for example as Panhard-Levassor made in 1897, has yet to be discovered. No later than this spring second-hand Panhard vehicles were eagerly sought by well informed buyers who were glad to pay the high prices demanded for them in spite of the fact that their mileage averaged high in the thousands every year since they first went into service.

It would seem, then, that the life of a motor vehicle, whether for business or pleasure, is altogether dependent upon the care it receives.

ANALYSIS OF MOTOR BUS TROUBLES

AFTER analyzing the troubles which have arisen from the operation of motor buses for 800,000 miles, the president of the Society of Motor Omnibus Engineers declares that about 45 per cent of them are due to impure gasoline supply and faulty carburetter action; 25 per cent to ignition; 23 per cent to gear and clutch disorders; 6 per cent to the bad behavior of engines, and 1 per cent to unimportant causes.

Most of the troubles ascribed to gasoline could have been avoided. They were nearly all traceable to the presence of water in the gasoline, a badly designed filter, or no filter at all, being fitted between the fuel tank and carburetter.

Ignition troubles were blamed to a badly designed sparking plug. Magnetos gave very little trouble, and for the period under consideration none were re-magnetised. The faulty action of gear and clutch, while represented as a common defect in the report, really caused very little inconvenience, being quickly repaired and being almost wholly due to the clutch slipping. In the opinion of the engineer making this report, the leather faced clutch is not a promising design. It is described by him as "makeshift" construction.

Many of the vehicles which were under observation while the statistics presented were being obtained, have been in operation on the road for over three years.

GOOD EXECUTIVE MANAGEMENT

ALL who have observed the regularity with which the London motor omnibus performs its work have marveled that such precision in operation should be witnessed in a class of service which really has not yet had time to be brought to its highest development.

Traffic engineers, quite as skillful as any to be found in railway service, are usually in charge of the large bus services, and the system which these efficient officers have evolved will before long undoubtedly become models for commercial houses employing large numbers of power wagons. The best men among minor employees are frequently appointed as road engineers. These men have a thorough knowledge of motor vehicle mechanism. They are placed at various points along the route, and if a vehicle breaks down immediately set to work to put it into commission again.

Drivers who have distinguished themselves by the manifestation of more than ordinary skill are expected to come to the rescue of their less skillful brothers when the latter are discovered to be in distress. If these expert drivers pass a bus which has temporarily become disabled, they are expected to turn their vehicle, which is in perfect working order, over to the driver of the vehicle which is not in good working condition, and proceed to get the refractory machine into thorough working order.

If an omnibus breaks down, and there is no road engineer at hand to remedy the trouble, any driver passing the crippled vehicle is expected to report the interruption to service to the first road engineer encountered, or, failing to find one, to telephone operating headquarters.

One establishment in which this excellent system for maintenance of satisfactory traffic conditions is observed, has its own drafting room where parts of motor vehicles, not found quite satisfactory, are re-designed. The company even cuts its own gears, using nickel chrome steel for the purpose.

When a vehicle has traveled 15,000 miles it is thoroughly overhauled in the erecting shop.

MOTOR EXPRESS COMPANY

BAGGAGE, express matter and passengers are to be transported by the Pittsburg Automobile Express Company, a concern which has made application for a charter to operate in Pittsburg, establish a charging station there and sub-stations in Allegheny and the surrounding districts. The promoters of the enterprise are all experienced business men who are well qualified to operate a business of the nature described.

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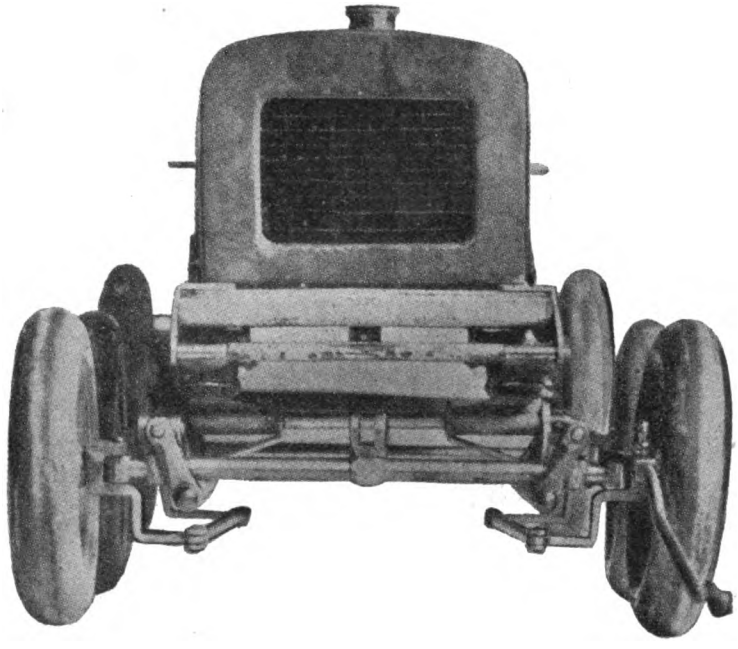


View showing steering arrangement and suspension of bogie motor wagon. The lug on the middle of the front axle is only intended to take a draw-rod, with which to move the vehicle.

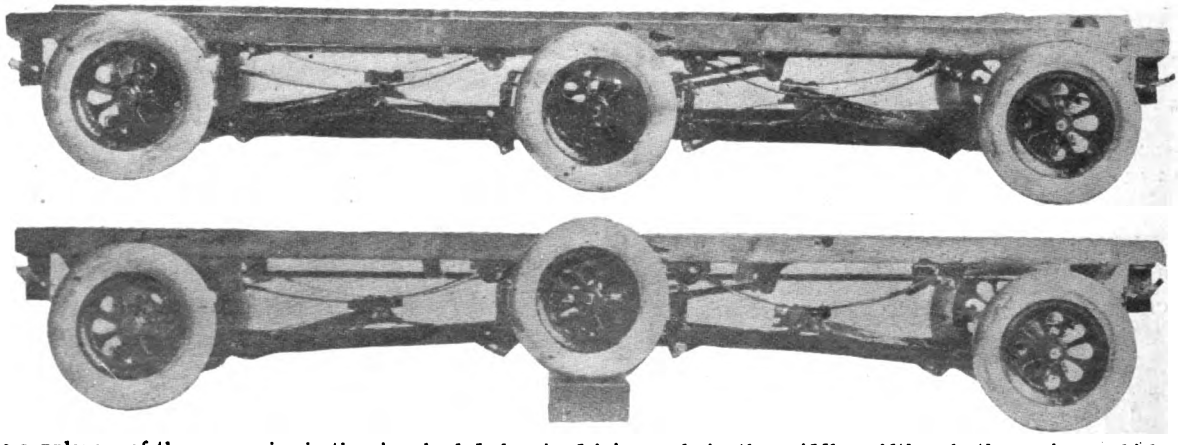
Six-Wheel Wagons

Type of Vehicle Which Promises to be Extensively Used in Interurban Transportation

SIX wheel wagons have attracted the attention of French automobile engineers for the reason, as Lieut.-Col. Espitalier points out in his article in this issue, that they will carry nearly as much weight as two four-wheel vehicles while only requiring two-thirds of their motive power.

As heavy wagons of this type promise to be extensively used in interurban merchandise transportation it becomes worth while to consider their construction. In the designs illustrated the chief objects aimed at are as follows: To obtain smoother travel; to reduce wear on tires; and to lessen damage caused to road surface by heavy motor traction. The advantages of having a smooth running vehicle are many. In the first place the vibration of the vehicle, being minimized, permits the use of light parts. Light construction lessens the primary evil. But though vibration is a fruitful source of wear and tear on parts faulty design is responsible for much of it. Some heavy wagons are so imperfectly designed as to be unable to successfully resist road stresses. Frame distortion, for example, is common in motor buses and it in turn gives rise to other troubles which are not guarded against by flexibility of drive.

In a six-wheel wagon the vertical movements due to road inequalities are reduced at the frame by fifty per cent. In addition the employment of flexible springs still further decreases the tendency toward frame distortion. One of the accompanying drawings shows the behavior of the frame in a bogie-wheel wagon when an obstruction is encountered and how the frame of a four-wheel wagon acts under similar conditions. In the six-wheeler the bogie pin is equidistant from the two pair of bogie wheels, and is the same distance from the center of the rear axle as is the center of the front wheels in the ordinary wagon. If, then, both wagons pass over the same obstacle, it will lift the wheels in each a similar



Showing the suppleness of the suspension in the six-wheeled chassis, driving axle in the middle. Although the springs which support the frame are only made from a single plate, they are by no means unduly weak.

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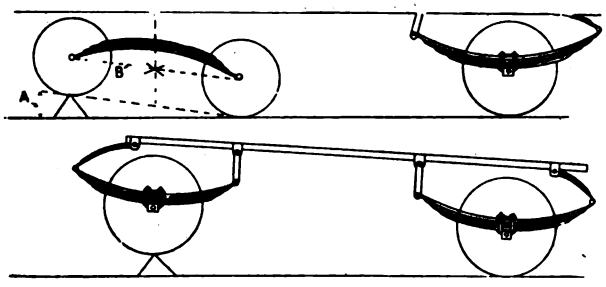
height; but in the case of the bogie vehicle it is obvious that only one axle can pass over the average obstruction at a time, the other, perforce, remaining on the ground level. As the bogie pin is placed midway between the two wheels, it and the wagon with it, is therefore only lifted half the full height of the obstruction, and thus the shock due to inequalities of the road are lessened.

The method of suspension has much to do with the success of this construction. In the end view of the design illustrated the coupling rod of the steering gear has been disconnected and swung clear in order the better to show the suspension. To each of the bogie axles, and at either side, are attached lugs from which swing links that at their lower end are attached to longitudinal members which couple the two axles on both sides and midway support the cross tie on which rests the springs that take the weight of the wagon.

The angle of the steering is different for each pair of wheels. In the model in question the extra pair of steering wheels appear to cause no extra resistance when turning, although the resistance of the vehicle to sideslip, even when turned at the sharpest angle, was enormous. Perhaps this resistance to sideslip and also



Showing relative movement due to road shock.

to upset when sharply turned is the most noticeable feature of this machine.

Many advantages not possessed by the construction just described are to be found in the modification of it now about to be presented, and designed by the same engineers. The characteristic of this construction is its middle axle driving and attendant supple suspension, which latter feature is particularly valuable in a heavy motor vehicle not fitted with rubber tires. One of the photographs shows the middle wheel passing over an obstruction without appreciably disturbing the frame. The method of spring suspension is not unknown in the railroad world, being somewhat simliar to that sometimes employed on locomotives, but instead of an unbending compensating beam connecting the rear end of one spring with the front of the spring on the next axle, and rocking about its center on a pivot secured to the frame of the machine, we have another long spring of inverted camber, and this again is connected at its center to a similar spring of reverse camber which supports the framework of the machine, as shown in the illustrations. The axles are held in position relatively to the frame and to each other by jointed radius rods that permit of vertical play. Such an arrangement, though somewhat complicated, affords such excellent springing as would probably fully justify the additional parts, especially as a body of exceptional length can be obtained with a vehicle built on these plans.

As each end-axle is made to take steering gear, these long machines can be made more handy and capable of taking sharper turns than four-wheeled chassis of much less length.

Although the additional wheels and axle have decided disadvantages, the demonstration afforded by these models makes one wonder whether as many motor vehicles would have but four wheels had they not immediately succeeded to the horsed conveyance. If the drawbacks are serious, the advantages, for heavy work at least, outweigh them.

MOTOR VEHICLES IN MINING REGIONS

THE use of automobiles for transportation purposes in countries where the heat and the atmosphere are trying upon animals in becoming more and more general, says a writer in the Washington Star.

"I have told you several times of the use that is made of them by the miners in Peru and Bolivia, who carry their ore over the mountain passes in motor cars at altitudes where horses and mules cannot exist. And the miners of Mexico are gradually adopting the same method. A Boston company which is operating two big mines in the Guanacevi district of Durango has recently imported a number of sixty-horse-power trucks for hauling ore from their shafts to the nearest railway station. Each car is equipped with a drum containing stout steel cables which will be used in assisting the ascent of heavy grades. The cables will be attached to trees or posts set in the ground by the roadside for that purpose some distance ahead of the machine, and will be taken up by the drum as the car ascends the grade.

"It is asserted that any reasonable mountain road can be crossed in that way and the experiment is being watched with great anxiety by hundreds of miners whose property is worthless unless they can find some economical method of getting their ore to market. The grades on the mountain roads are often so heavy that teams of horses or mules are useless, but if this method of assisting motors proves successful, the situation will be relieved and many a miner will find his fortune."

OPPORTUNITY FOR ENTERPRISING AMERICANS

COUNSUL G. Jarvis Bowens, of Guadaloupe, writes that there is an opportunity just now for an enterprising American to run a daily passenger line of automobiles from that place to Basse-Terre, a distance of about 40 miles. The government of that West India island will grant a subsidy of $6,000 annually for the assurance that the mail will be taken twice daily, and will require a deposit of $1,500 to insure faithfulness of contract, which can run for twenty years. With the present facilities, travel between these towns is quite a problem. It takes six hours or more by boat or diligence, neither of which run daily, and it is said that a daily motor line would pay. It would require about six machines, one each of 10, 8, 6, 4, and 2 seats.

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Solidity of Roads

Third Article on the Importance of Good Roads for Heavy Motor Vehicle Traction

(By Lieut. Col. G. Espitalier)

A CAR builder has observed that the reason for this great difference in the distribution of load for the two types of vehicles is a matter of fact. The driver of a commercial vehicle, who is not heavy, is in front with the motor which, whatever its weight, is lighter than the merchandise accumulated at the back. But this arrangement is not always made designedly, and there is, as a general rule, no obstacle to making a more uniform distribution, and thus considerably easing the driving axle. This is just what will be obtained by adopting an idea which is beginning to make a mark in the automobile world—the six-wheeler.

Immediately it becomes a question of carrying a considerable weight—and it is impossible to exceed a certain limit per axle, fixed by the law, the resistance of the road, or the various parts of the vehicle—it seems natural enough to multiply the points of support. This is what has been attempted in forming road trains. But if the weight cannot be divided, or if the needs of traffic demand separation into independent loads, too heavy for a four-wheeler and yet too little for two separate vehicles, a single lorry, mounted on three pairs of wheels, should be employed.

Take the case of a car with pneumatic tires, which can carry little more than 1 1-2 tons per axle. This will only give three tons of total weight for a four-wheeler, presuming uniform distribution. The dead weight accounts for 1 1-2 tons, and for the useful load only a similar weight is left. When another axle is added the total weight can be increased from 3 to 4 1-2 tons, and nearly all the increase is for the useful load. No doubt the underframe would have to be slightly reinforced, and the weight of the motor would be somewhat greater, though not proportional with its necessary increase of power. Large motors, as we know, are less heavy per horse-power than small ones, and their efficiency is greater. The difficulty can be settled by adding 600 lbs. to the dead weight, giving an increase of 2,400 lbs. in the useful load.

A six-wheeled lorry will carry as much as two four-wheelers, with a motive power only two-thirds of that required for the two smaller vehicles.

The difficulties, however, begin when we endeavor to realize this idea. One will guess that it is not merely a question of fixing a rigid frame on three axles, even with springs, for when passing over a culvert or projecting part of a road one pair of wheels will carry nothing, while the others will be as heavily loaded as with four wheels. It is essential, therefore, to have interdependent axles, and the driving axle, in the center, must move vertically in relation to the others without any change in the distribution of the loads. This last point is imperative.

Captain Lindecker, a military engineer, has given a very simple solution to this question of three axles, which is expected to give excellent results. Only the steering wheels have plate springs, the inner hangers of which are directly connected with the driving axle by beams pivoting on fixed points; moreover, these beams are themselves flexible. It is easy to understand what happens on meeting with an elevation in the road or a channel. The middle wheel rises or falls without losing contact, and, besides, as calculation demonstrates, the middle axle always supports one-third of the total load if the beams are equal, or any other given fraction previously fixed if not equal. As previously stated, the front and rear wheels are compensatingly dirigible. For this it suffices to connect them suitably with the steering wheel, so that they will be simultaneously governed and moved at the same angle.

In addition to all these advantages there is less danger of side-slip with a six-wheeler, as the nature of the road never affects the two pairs of end wheels at the same time. Also, the distance between two axles being necessarily small, turns can be made in a circle of shorter radius.

Let me now say a few words about power, or rather the various sources from which it can be obtained. In 1897-98 steam was regarded as preferable to anything else, but this was before the inventions which have been conferred upon us by the gasoline motor of today. The latter is free from nearly all the defects with which it was formerly reproached. It is as silent as need be; it is no longer subject to inexplicable vagaries and breakdowns; it is flexible, and adapts itself to the most varied conditions of the roads; it does not require an exceedingly skilled driver; and, finally, great efforts even, which seemed the exclusive characteristic of steam engines, are not foreign to internal combustion engines.

Some time ago an investigation syndicate was formed at Marseilles, composed of shipowners, members of the Chambers of Commerce, and transport contractors. The object of this syndicate was to examine the best means for carrying on the traffic of the port by aid of motor lorries. The first conclusion of these investigations was the rejection of steam, but it has to be admitted that this decision has been appealed against. Certainly one may object that steam engines are so old, and have been so carefully studied by builders, that no further improvements can be made. But is there no more hope? Is it not possible that, under pressure of fresh needs, an unlooked-for development may occur which will enable steam engineers to recover lost ground from their rivals of the internal combustion engine cult? Already the fuel question has made a great stride by the satisfactory employment of ordinary paraffin, which is cheap. Who can fix an impassable limit for the progress of science?

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Their Attention

GAUZES fitted to the air intake of any kind of carburetter should be frequently cleaned. Otherwise they rapidly choke up with oil and dust, the result being that insufficient air passes to the carburetter, which means that the suction on the jet is increased and more gasoline taken to the engine than should be the case, resulting in heavy consumption, boiling water, etc. Unless a gauze is fitted a carburetter will choke. But it is often overlooked that chokage in a carburetter is due to chokage of the gasoline passage, and not to the air passages, and that dust getting into the carburetter by way of the air intake cannot get into the jet or gasoline passage. The only damage that dust can do is to get into the engine and pass out through the exhaust valve. While in the engine it can do little harm. Obviously, the best thing to do is to fit a large gauze which is detachable, and keep it clean.

GOOD MUFFLERS AND LUBRICATION

In some wagons in which muffler design has been carefully studied in order to avoid back pressure this end has been accomplished so effectually that a very feeble pressure passes to the lubricator, and sometimes on a cold day no feed therefrom can be obtained. When this is so there are two courses open. The first is to force some oil through the pipes, and that can be done by getting someone to put the sole of his boot over the exhaust outlet, when the throttle can be opened; the engine will not race, as it will be slowed by choking the exhaust outlet. This will cause the oil to pour through the lubricator sight drip jets in fine style. The second procedure is to slightly warm the oil. This can be done by arranging a leak somewhere.

A SLIPPING CLUTCH

A slipping clutch can be detected by ear. An experienced driver can tell if the engine is working at too fast a pace in relation to the speed of the car. If, however, he is uncertain, he should put his engine out of gear, dismount and feel the male portion of the clutch with his hand. If the clutch has been slipping, the friction will cause it to become hot. The slipping is usually caused through oil in the bearing surface. The remedy is to wash with gasoline and then apply fuller's earth. Continuous slipping may burn the leather, necessitating its renewal.

BRAKE INSPECTION

Those who employ drivers should make frequent inquiries as to the condition of the brakes and should demand that they be kept in perfect condition. By jacking up the back wheels the brakes can be easily tested. The side brake lever can be put half way on the notched quadrant to find if the brake is holding the back wheels and holding them evenly. By advancing the lever notch by notch one can discover at what point the wheels are locked, and at this point the lever should still be able to move forward on the quadrant. The foot brake can be tested in the same manner. The driver should sit in his seat and press the foot pedal while someone else tests the wheels. When the wheels are locked the pedal must not have been pressed down to the floor board, but must still have space underneath to allow of more forceful application.

CLEANING THE CIRCULATION SYSTEM

To clean a circulation system that has become scaly, dissolve about three-quarters of a pound of caustic soda in the water contained in the tank. Then start the engine and let it run for an hour. This should clean out the tubes, connections and jackets. Then flush the radiator by connecting it to a water supply. Fill and empty the entire water system of the wagon three or four times, so as to be sure of removing every trace of the soda solution. After that there should be no further trouble with scale for some time.

A KNOCKING MOTOR

When the motor begins to "knock" draw back the spark lever and see if that will stop it. If the sound is a sharp metallic click, and cannot be stopped by manipulating the ignition, look at the pump. A "pound," to be distinguished from a "knock" by its deeper muffled tone, is often due to a worn brass in one of the connecting rods. If so, it will manifest itself most strongly when the engine is laboring on a hill, and will not appear suddenly.

REFINEMENT OF STRUCTURAL PRACTICE

THERE are symptoms that the practice of lubricating spring joints, occasionally to be observed in touring car construction, will within a very short time be extended to the construction of commercial motor vehicles of the heavier order. One concern making motor omnibuses has for two years past exhibited such a refinement in its vehicles. It is claimed by this firm that the lubrication of spring joints is equivalent to a large reduction in first cost, lubricated spring joints adding materially to the life of the vehicles in helping the springs to the exercise of their proper functions.

EARNINGS OF MOTOR BUSES

SOME idea of the profitable character of the service of motor buses in London, and the extent to which the public patronize these vehicles, may be gathered from the fact that recently the best equipped line in the city received in fares the sum of $18,801.60 in the course of a week.

A gasoline motor garbage wagon has been shipped from London to Cairo. The engine is of the double-opposed cylinder type, developing 20 hp.

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Information For Buyers

ELECTRIC BUSINESS VEHICLE.—The Pope Motor Car Co., of Indianapolis, recently published a small pamphlet describing its electric business vehicles which range in carrying capacity from 1 to 5 tons. The company makes a specialty of manufacturing 1, 3, and 5 ton vehicles.

SAVING IN DELIVERY.—One who has confidence in the Logan wagon contracted with a large grocery house in Detroit to do all its delivering. Last year the expense was $8,000, eight horses and wagons being used. It is expected that the contractor can do the work with three Logan wagons at a little more than half that sum, and that he will make a profit on his investment.

CRUDE OIL ENGINE.—H. R. Palmer, of Cleveland, has perfected an engine which uses a low grade crude oil costing about 3 cents per gallon. Recently he made a demonstration of it before several prominent automobile manufacturers and it is said that an option on the American rights have been given to a prominent maker. An interesting feature of the engine is that no outside means of cooling the cylinder is necessary. The moving parts of the cylinder are insulated from the combustion chamber, doing away with the necessity for cooling.

MOTOR FIRE VEHICLE.—The combination chemical engine recently made by the Pope Motor Car Company of Indianapolis for the Hopedale (Mass.) fire department is now doing acceptable fire service. It has a speed of sixteen miles an hour, and is good for a 13 per cent grade.

A LARGE ORDER.—The largest order for automobile trucks ever taken in Pittsburg was forwarded lately by the Fort Pitt Automobile Co., who sold eight 20-horsepower Oldsmobile gasoline trucks to Kaufmann Brothers. These trucks have a capacity of 1.5 tons and will be used for general delivery work in the great department store. It is likely that in a short time the firm will entirely abandon the use of horses in its deliveries.

MILLION DOLLAR CONCERN. — The Williams Motor Carriage Company is being organized in Akron, Ohio, to manufacture automobiles and power wagons. The concern will have a capital stock of $1,000,000.

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Municipal Wagons

Economy and Variety of Service Yielded by Vehicles Owned by City Corporations

(Special Foreign Correspondence)

NEARLY all the big city corporations of Great Britain now use motor vehicles for some purpose or other. The majority employ them for street cleaning and watering, but a great number of municipal motor buses are coming into use. Not a few municipalities have motor tower wagons for use in connection with the overhead trolley wire equipment of electric tramways; several use motor parcel delivery vans; others have motor fire engines; still others make use of motor ambulances; and many keep smart staff cars to convey municipal officers in the execution of their duties.

Steam, gasoline and electricity are each used as a source of power in these vehicles. Until recently steam led. Now gasoline is in high favor and will presently lead, if it does not do so already, in view of the numbers of prime-movers on order by municipalities. Electricity has only recently come to the front as being specially suited for fire and ambulance work.

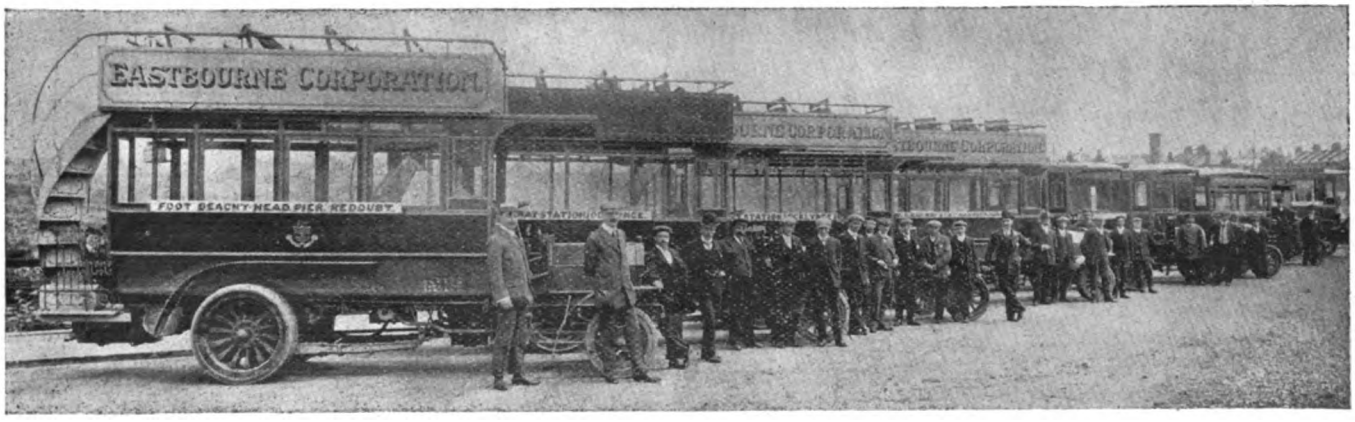
Overcoming Opposition

Steam was favorite for many years owing to the fact that British motor engineers entirely neglected, or did not suspect, the great possibilities of gasoline for industrial vehicles. Indeed, the cause of much of the opposition of the British public, and therefore of the authorities, to motor wagon traffic was due to everybody bewailing the impossibility of adapting the gasoline motor to the propulsion of vehicles for business purposes. The gasoline vehicle was regarded as the rich man's toy, and the democratic public abused it for that very reason.

Several eminent engineers, however, recognized that the steam driven vehicle would meet the requirements of many businesses if only the authorities would permit a sensible traveling speed and not restrict it to a maximum of three miles per hour in the open country, and two miles per hour in towns, as if the vehicles were traction engines.

The authorities, of course, were not convinced in a day, as their engineers are cautious individuals. These gentlemen not only had their own prejudices to overcome, but before any expenditure on a power wagon was sanctioned had to prove to the satisfaction of their respective councils the economy of installing a modern system of traction in substitution for ancient equine systems, which so far had given satisfaction.

Of the many power wagons now in use by British municipalities not one has been



A Fleet of Municipal Motor Buses.

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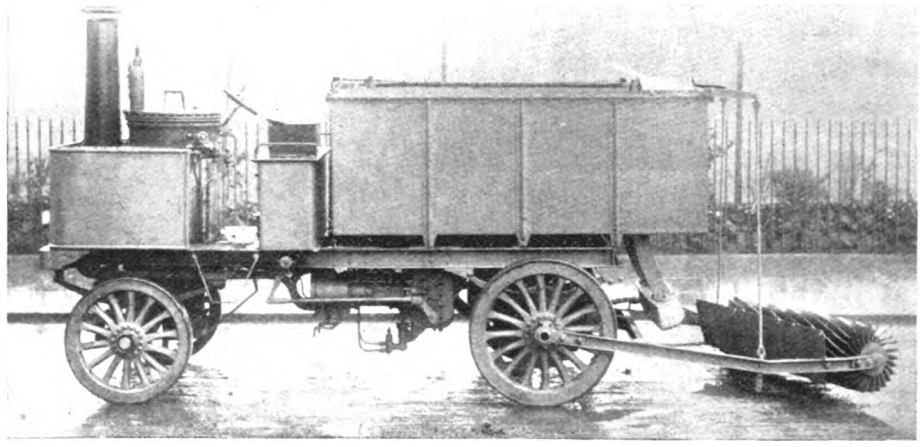
recklessly bought. A sale is often only completed after many weary months of suspense on the part of the manufacturer's agent while the council and the local press discussed the advantages of the proposed purchase.

Attitude of Municipal Engineers

Before a British municipal engineer decides to recommend his council to purchase a power wagon he has to consider several factors which will influence him in arriving at a decision. Questions affecting his own responsibility and labors naturally have precedence. He will have to overcome an innate prejudice against the use of any implement which will add to his own burdens of office as well as to the burdens of the roads under his control. Once convinced, however, as most British municipal engineers now are, that the use of motor road vehicles, either as vans, buses, wagons or tractors is bound to steadily increase until it is greater than horsed vehicle traffic, and will in a few years constitute almost the only road traffic of the country, he will consider the reasons which are leading to increased motor traffic. These he finds are chiefly questions of economy of motor over equine methods of traction, and he thereupon resigns himself to the inevitable, recognizing that further opposition on his part will be abortive so far as stopping motor traffic is concerned, but pregnant with trouble to himself if he does not at once put the roads in his care into a condition fitted to carry the new class of traffic.

Being convinced of the general economy of power wagons he will then have to consider whether any benefit will accrue to his council by the substitution of motor vehicles for horsed vehicles in the department he controls. As this is merely an arithmetical calculation, now that every description of power wagon is thoroughly successful under proper care and supervision, the municipal engineer soon settles the point after pondering the possible opposition his suggestion to purchase will receive. Not the least opposition he knows will come from the quidnuncs and ancients of very conservative tendencies in his district, but, as a rule, if he has his figures right, the common sense of his council will be with him.



Employed In Municipal Service.

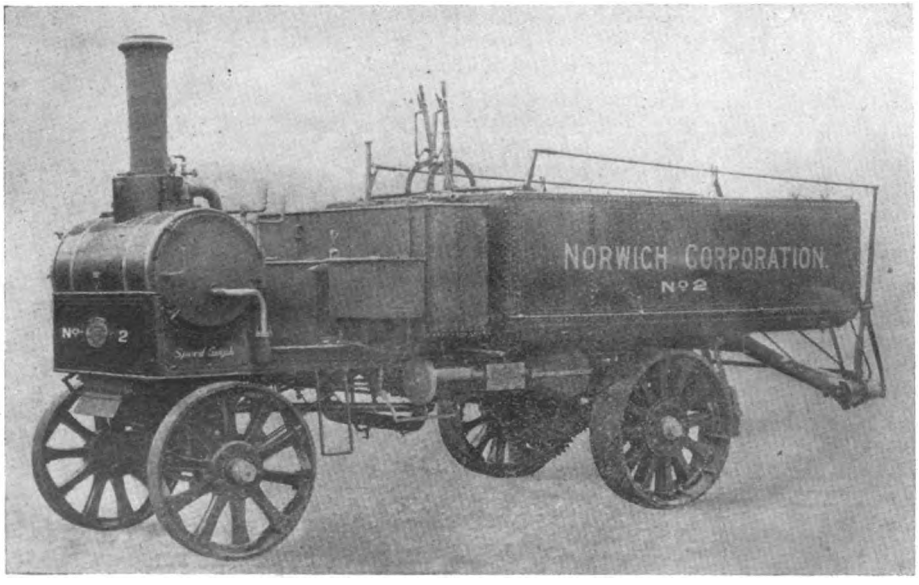
The Choice of Vehicles

To assist American municipal engineers in arriving at a correct estimate of the value of power wagons, we propose from time to time to give authentic figures relating to the experiences of their British confreres in this direction. The engineer of a city or town, we may, however, first explain, will find rather more problems to consider than a country surveyor in deciding as to the class of power wagon he requires. The town surveyor, for instance, will have to choose between vehicles for separate purposes and vehicles which perform several functions, such as watering or sweeping roads, scavenging and removing dust and house refuse, and occasionally rolling roads and paths. The country engineer will be concerned merely with watering, hauling or rolling.

Any make of power wagon can be adapted to water and collect dust or haul road metal. A machine broom can also be added if desired. A power wagon convertible into a road roller, however, has to be especially constructed in order to provide for the proper ballasting of the machine when rolling. It would not be advisable, although of course possible, to use such a machine for any purpose but hauling material and rolling.

Certain British municipalities were a short time back in favor of using power wagons for laying special solutions on the roads to prevent dust. One or two experiments were made and were successful, but it is now considered far more sensible to spend money, previously used in oiling roads, in properly making up the surfaces with efficient binding materials which will not be sucked up and distributed into adjoining houses or fields by every passing vehicle.

With regard to multiple-purpose vehicles the engineer will have to closely compute, according to the area under his control, the comparative economy of dividing two or more classes of work among as many different vehicles, or setting one or more vehicles to carry out each class of work at different periods of the day, the vehicles working in one district or in separate districts as may be deemed advisable.



Another Municipal Vehicle.

Superiority of Power Wagons

The actual cost per given area of sweeping, watering and refuse collecting by motor as against the service of horses varies according to local conditions. Still, as will be later proved, experience has shown there are decided advantages to be derived from the use of power wagons for single or multiple purposes. The latter types are particularly successful where there is sufficient of two classes of work to keep a vehicle busy, but insufficient of one class. The multiple- purpose vehicle avoids the necessity of having to stand idle at times. Every hour of work obtained from a power wagon,

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it need scarcely be said, counts in its favor, and is a source of profit to its owner.

As a rule seldom less than five horses and as many vehicles or brooms are displaced by a five-ton power wagon in use by British municipalities. Vehicles of this load capacity are most suited for general work and are accordingly extensively used by British authorities. Three-ton power wagons have been used, but were not found very successful owing to their inability to take a bulky and heavy load when desired.

Annual Charges

The annual charge on a 5-ton gasoline wagon, convertible into a water cart or machine broom, averages $2,112 on a capital outlay of $3,600 for the wagon and $720 for accessories. If used as a dust cart, or for haulage only, the annual charge is about $120 less. A steam wagon of the same load capacity costs about $1,824 annually to run on a capital outlay of $2,400. If used as a machine broom, water cart, or roller, it will cost $120 more annually and an additional initial outlay of $720. The gasoline wagon, it should be noted, does far more and quicker work than the steamer. Our own opinion, however, is that a properly constructed three-ton gasoline municipal vehicle will do quite as much, if not more, work than a 5-ton steam wagon which, although liable to stand more knocking about than a gasoline wagon, is less handy in every respect and very clumsy. The annual charges just mentioned include interest at 5 per cent on capital; 15 per cent general depreciation; and cost of fuel, oil, insurance, repairs, wages, etc.

A water and refuse steam cart working in London runs about 200 miles weekly; at Newcastle a refuse steam cart runs 250 miles weekly.

The annual charges on horsed dust carts, brooms and water carts, displaced by a 5-ton gasoline or steam wagon, is in Great Britain $2,851.20 made up as follows:

Cost of 5 horses and 5 sets of harness such as British municipalities use, $1,200.	
Interest thereon at 5 per cent	$ 60.00
Depreciation at 10 per cent	120.00
5 drivers at $5.76 each per week....	1,497.60
Fodder for 5 horses at $3.36 each per week	873.60
Veterinary and shoeing	72.00
Stabling	120.00
5 dust or slop wagons and machine brooms, $720.00	
Interest and depreciation thereon at 15 per cent	108.00
	$2851.20

This amount, it should be noticed, does not include the cost of keeping reserve horses and stable attendants. Further, in refuse collection and other similar work two men are employed with each horsed wagon, but two, or three at most, are all that are required to attend to a motor vehicle which does the rounds formerly requiring 5 horsed vans and 10 men.

Cost of Hauling

The actual cost of hauling stone or gravel by a 5-ton gasoline wagon is 2.96 cents per ton mile, or 3.70 cents per yard mile; by a 5-ton steam wagon or light steam tractor 3.36 cents per ton mile, or 4.20 cents per yard mile; by horse and cart 6.40 cents per ton mile or 8 cents per yard mile. In simple haulage it will be noticed that the gasoline vehicle clearly exhibits its superiority over steam, although the annual running and other charges on a gasoline vehicle are greater. The economy is made on its greater speed and consequent larger capacity for work.

The cities of Blackburn and Gateshead have used 5-ton steam wagons for some time and save $508 and $998 respectively per annum thereby. Cartage and watering motors are used in Chelsea, Bournemouth, Cardiff, Norwich and Smethwick, and in each case a large economy is effected.

Economy of Motor Watering Carts

Strangely enough the greatest economy is generally found to be in watering, probably because the big power wagon tank covers the ground so much faster and has greater capacity than the horsed vehicle. Unless the water van is used all day the wagon is always constructed so that between times it can be used for refuse collection or general haulage. A slip-in tank is usually provided to fit inside the raised boarded sides of the wagon, so that to convert the vehicle for carrying loose material all that is necessary is to lift or draw out the tank. Several water carts are exclusively so employed in London city, where the streets are washed every night, regardless of weather conditions.

The success of refuse gathering by motor depends very largely upon the system of collection. It is a thoroughly bad system which does not give a great economy over horses, notwithstanding the numerous stoppages of a power wagon to empty bins and boxes, aand the lengthy period necessarily occupied in completing a load. Liverpool and other cities use motor vehicles solely for this purpose with profit.

Arranging the Routes

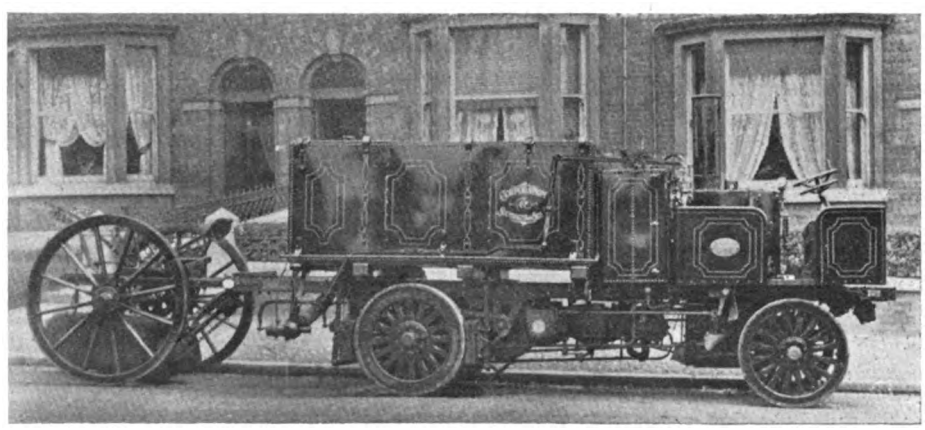
A power wagon should have its round arranged so that the total time occupied in running around a district, picking up a load and returning to unload, should approach as near as possible the time previously occupied by one of the displaced five horsed vans in proceeding from the dust destructor depot to the farthest point of the collection area and returning with

Municipal Tower Wagon.

a load. Each power wagon should work in concentric circles, commencing loading near the depot and working around until it is completely loaded at a point not far from the shoot. In advance a man can proceed along the collecting route and bring loaded refuse receptacles into batches of, say, half a dozen in order to lessen the time occupied in loading. The rapid removal of big dust loads by power wagon saves the City of Westminster $1,400 per annum.

Although it has been proved in Bootle and Acton that street brushing and slop or dust carting by motor are cheaper than when performed by horsed machines and carts, motor brushing and carting is not as generally adopted as it should be. The advantage of being able to cart away road sweepings from each section of road as it is cleansed is enormous.

(To be continued.)



Municipal Water Cart and Brooms.

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Newspaper Automobiles

Opportunities for Employing Motor Vehicles in Gathering News and Delivering Papers

THE advantages of the automobile as a permanent auxiliary in gathering local news for publication in morning or afternoon papers is too obvious to require elaborate demonstration. Other means for rapidly conveying reporters to the comparatively remote scene of an important happening are often wanting, and when they exist they are invariably found to be inferior to the motor car.

The economy of time is everything to an alert newspaper. The occasional delay of a few minutes may mean the momentary triumph of a rival which exclusively presents intelligence of unusual interest. Repeated errors of this sort, in a business that is sharply competitive, soon impairs a reputation for successful activity, estranges readers and eventually sours advertisers.

But there is another branch of newspaper work which, though it lacks the spectacular features of reportorial enterprise, is even still more in need of the service which the automobile affords. The delivery service of both morning and evening papers, notwithstanding it is largely facilitated in some cities by the front platforms of street cars, is very imperfectly and expensively managed. Motor delivery wagons would greatly improve such service, permitting quicker deliveries to agents and railroad depots, larger vehicle loads and reduced operating expenses. At the present moment, however, the automobile is by the general run of daily publications looked upon as a speed machine without usefulness in the special fields indicated. Here and there the liveliest interest is being displayed in its economy as a merchandise carrying vehicle, but as a rule publishers have not yet grown to appreciate its wide value as a utilitarian instrument. The advertisement its employment unfailingly yields is just now more attractive than its less splendid but more enduring sober work.

Nearly every influential daily employs the automobile in news gathering. Some own a machine, or several of them. Others pay a fixed monthly rental for their use to a motor car agent who supplies a driver at all hours of the day or night. There are more who rent than own vehicles, probably because of the exaggerated responsibilities of ownership. In the smaller cities, however, the tendency is toward outright purchase.

A typical newspaper automobile service is to be found in Bucyrus, Ohio, where two publications, the *Evening Telegraph* and the *Weekly Journal,* both under one management, derive undoubted advantages from its establishment. One of the managing partners of these papers thus describes the value of the machine in news gathering:

But few papers recognize the importance of the automobile in news gathering. Newspaper men particularly will appreciate the importance of time in getting a story in hand. From the time the first tip of big news comes into the office, until all the facts have been collected and transcribed to paper, and the copy is in the hands of the typesetters, every moment is of the utmost importance. The first reporter to tap the source of information from which the best report can be had is the man most sure to get the best story. This scramble for time takes the nature, on a newspaper, of a fire department in getting to a fire. To be the first on the ground and to get the most particulars, and beat back to the office with the story, is a long way toward the best report, which makes the most popular paper.

The first call upon our automobile was an hour before press time when a report reached the office that a woman had met sudden death in a peculiar manner five miles south of the city. There was no telephone and no particulars could be had. Within five minutes after the tip was received our automobile, carrying two reporters, was on its way, and within an hour the story was being put in type. This record would have been impossible without the use of the auto, and at the time of day the tip was received any detailed report of the matter would have been out of the question for that day's issue.

Another quick trip took the auto, two reporters and a photographer seven miles from town, where two aged spinsters had lain down upon the railway track and met death locked in each other's arms. The reporters were on the scene long before the coroner and abundant facts for a good story were collected. From the time of leaving the office until ready to return the time was not an hour.

On another occasion a wild man was running amuck in the northern part of the country and officials wanted a quick way of getting after the fellow and landing him in jail. A live newspaper is always looking for such opportunities, and as a consequence our reporters were with the officials in the automobile, and the man was landed behind the bars in quick time.

One of the best bits of news gathering the automobile ever did was on the occasion of a partial destruction of the buildings at the county fair grounds by fire. The grounds are a mile and a half from the business part of the city. Our papers had headquarters there with telephone connection. Late in the afternoon of the big day this message flashed over the wire: "The fair buildings are on fire, notify the department." There was a buzz indicating further particulars, and then silence. The connection was gone and no means of communication was left. The fire department was notified and a run for the grounds made. The automobile was on the scene within ten minutes after the first smoke was discovered. Ten thousand people were on the grounds and in the middle of an exciting horse race an exploding gasoline tank had fired the grand stand, which was almost instantly a sheet of flame. The fire spread rapidly until half the buildings were in flames. The only exit from the grand stand was cut off by fire, and people leaped upon each other in a frantic effort to escape. We had four writers at work on the fire. Copy was produced on the grounds and the automobile carried it to the office, where it was put in type. Trip after trip was made, and in less than two

The Start After "Big" News.

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hours the paper was on the street with six full columns of the story, one of the best "beats" of the year.

At another time the buildings at the county infirmary, seven miles from the city, caught fire. The automobile squad started a few minutes behind an electric trolley car, which carried the officials of the county bound for the fire. The newspaper machine caught and passed the car, got the story, had it written, in type and printed while all the other people at the fire were anxiously waiting at the infirmary for a return trolley car to bring them back to the city.

In this age of the automobile in business and pleasure the newspaper should lead. There are new victories for the paper with an automobile and an aggressive publication should not hestitate to get into the game while it still has that novelty which will give the investment a double earning capacity through its advertising value and the real work which it will accomplish.

Policing Motor Buses

Charges Against Motor Buses Not Sustained by Authorities Which Regulate Their Traffic

AN interesting investigation of the behavior of motor buses in London has just been concluded as a result of a conference between the police, who control all vehicular traffic, and a parliamentary commission which desired enlightenment.

It appears that the commission was appointed to inquire into abuses said to have been committed by motor bus companies in the operation of their business. It has been complained by the enemies of motor buses, among whom the London street railway officials are in the van, that the noise which the vehicles make in traversing their routes is unendurable. The police, however, state that the streets of London, which are tunnelled within a very few feet of the surface by water, gas and other companies, are largely responsible for both noise and vibration. There is not, in their opinion, undue noise to be heard as a result of the operation of motorbuses.

The speed at which motor buses are permitted to operate is another matter of complaint. The police say that excessive speed is a result of competition by the various bus lines. It has been suggested as a complete remedy for this offense that "control" stations should mark each route, and that vehicle drivers should not enter a control before the time scheduled for doing so without becoming liable to prosecution. It is the practice among horsed bus companies to employ the services of time-keepers in work very similar to that just suggested.

The police have not the slightest intention of limiting the number of motor buses to be operated on any given route. Their only desire is to control the behavior of the drivers.

The emission of smoke at the exhaust has also caused complaint. In dealing with this matter the system of the police at present is as follows: As soon as a bus is reported to be smoking at the exhaust an inspector is sent to discover whether the nuisance is due to a defect in the vehicle or carelessness on the part of the driver in over-lubricating. If due to the latter, the remissness of the driver will be noted and considered as evidence of incompetency when he applies for renewal of his license. In such cases, however, proper allowance is invariably made for the fact that the driver cannot very well see the smoke which is being emitted at the back of the machine.

As a remedy for dripping of lubricating oil upon the roadways it has been suggested that a tray be fitted to each vehicle in order to prevent the commission of such a nuisance. Most of the grease is spilled from the gear case, which is not easily made tight. The objection to the employment of a tray to catch the lubricant drippings is that there is danger of the contents of the tray taking fire. Another objection to its use is the risk of its encountering obstacles in the roadway. Nuisances of this kind are of course most common at spots where the vehicles stop. Sand is usually strewn over the oil spilled at these places.

The police do not permit drivers to use the streets to effect repairs of a serious character. Vehicles unable to proceed under their own power are either quickly put in condition by inspectors employed by the companies or towed at once to the garage. Traffic hindrance in London is to be avoided at all hazard.

THE STORING OF GASOLINE

STEPS have been taken to test the authority of the city in refusing Chicago garage keepers the privilege of storing gasoline under alleys. The matter will go to the law department for an opinion, and if permission finally is refused by the department of public works legal action probably will be taken to ascertain if the city has any discretionary power so long as the applicants tender the rate provided for in the law for use of parts of the public street.

A motor bus line is to be operated between Marysvale and Panquitch, Utah.

MOTOR BUSES FOR COLUMBUS

CAPITALISTS of Columbus, O., are considering the formation of a company to operate motor buses every ten minutes on two of the main thoroughfares of the city. The fare is to be five cents. Night and day service is to be furnished if the project is carried through. Both streets are asphalted and are about five miles long. They tap a densely populated residence district.

WHERE FUEL IS COSTLY

THE cost of gasoline in Cuba varies from 30 to 34 cents a gallon, according to grade. Alcohol, on the other hand, costs but 8 cents a gallon.

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Motor Mail Delivery

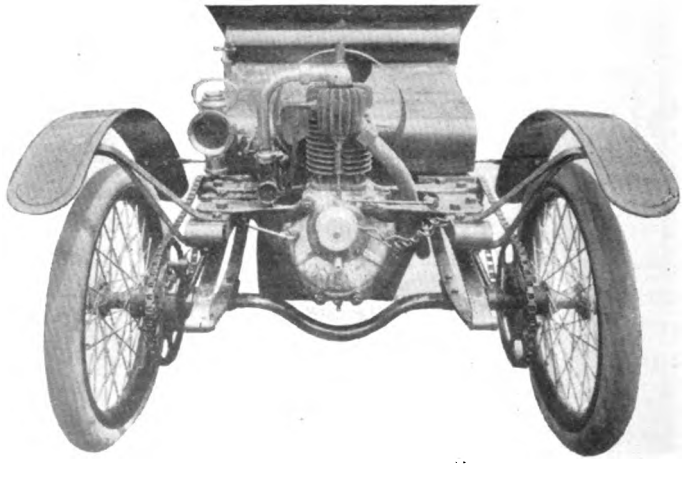
Rural Mail Carriers Anticipate Favorable Outcome of Test of Specially Designed Vehicle

RURAL mail carriers, who are now numbered by the thousand, regard with unusual interest the prospect of being granted official permission to cover their routes in an automobile which will be cheap in price, speedy and serviceable both in winter and summer. The accompanying illustrations show the type of vehicle which the Washington postal authorities are willing its makers should test in order to demonstrate its fitness for the service in contemplation.

It is not to be inferred from this, however, that, in the event of the test being successful, governmental permission will be granted for the promiscuous use of the machine on rural mail routes. Manifestly there are routes to be traversed where the machine would be at a disadvantage if the highway conditions were not suitable for its employment. It would, for example, be folly to use a motor vehicle on dirt roads which in winter were so deep with mud or snow as to make traction by any means well nigh impossible. Only carriers with routes having sound road surfaces, therefore, are likely to benefit by the proposed improvement in the means of locomotion.

The machine to be tested has been especially designed to meet the requirements of rural postal service. Routes in Virginia and Maryland have been chosen for the demonstration, the latter being typical of the average country road when in good condition, but the former being of quite an opposite character. The vehicle is to be tried out, therefore, under favorable and unfavorable conditions, although one naturally concludes that its performance under decidedly adverse conditions will not affect official judgment in pronouncing upon its utility in service to which it is well adapted.

The postal authorities very properly attach great importance to regularity of mail delivery and collection. Heretofore they have not regarded the automobile—such



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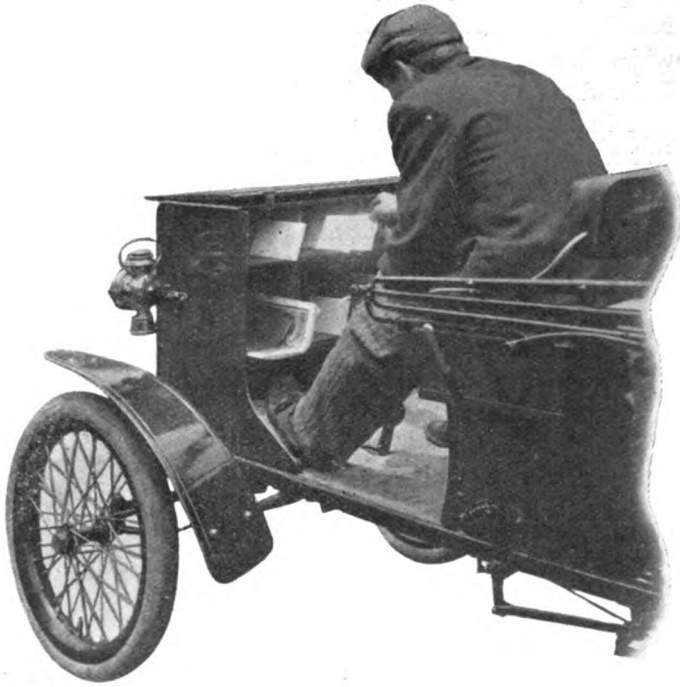
a vehicle as a rural mail carrier might, with his contract allowance of $600 a year, be in position to purchase—as being as reliable as the horse. This opinion, however, does not square with the facts if we measure reliability by the power to perform work expeditiously and satisfactorily under normal conditions of service. The interchange of horses and automobiles should be a fundamental of rural mail delivery so long as highways are at certain seasons more suitable for one than the other. There are few rural carriers who, if they purchased $750 automobiles, would fail to double their earning capacity by selling the leisure the superior speed would afford. Confined to the use of the horse their earning ability is necessarily limited by its inferior capacity for travel.



If the forthcoming test of the machine proves satisfactory rural carriers can buy automobiles of its class at $400. The vehicle is built like a buckboard. It has a 6 hp. gasoline engine, load capacity of 500 pounds, friction drive, and mileage on a single supply of fuel far in excess of the average mail route.

In front there is a compartment divided into large-sized pigeon holes for the various classes of mail. A hinged door closes over this cabinet, protecting the contents from rain or snow. The design of this compartment, however, is tentative, and alterations may be made to conform to the necessities disclosed by actual service.

REDUCED MOTOR BUS SPEED

BERLIN'S police have ordered the speed of motor buses to be reduced, on the ground that their comparatively high rate of travel was a source of danger to traffic generally.

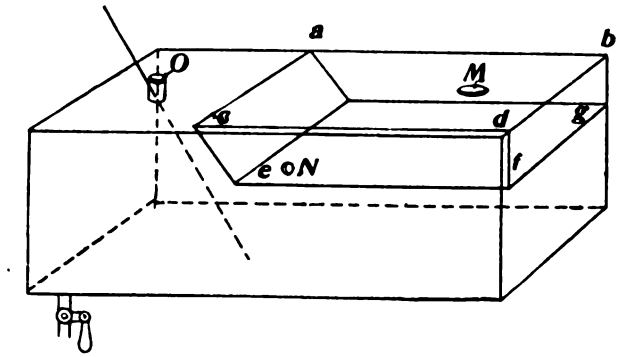
There is at present only one line of motor buses in Berlin, and this extends along the Freiderichstrasse, a busy main thoroughfare, which is very narrow at parts. The vehicles have been making this journey in 23 minutes, but henceforth they will have to do it in 26. As this new schedule comes within seven minutes of that laid down for the horse-drawn buses, the chief advantage of the self-propelled vehicle practically disappears. The police order comes as a surprise to persons who have watched the motor bus at work. The pace was not furious; neither could the drivers be said to handle their vehicles at all unskillfully. The buses skidded at times on a greasy road in turning to avoid collision, but on the whole they ran smoothly enough. Berliners make too much use of the brake. A brake has to be fitted to every horse-drawn vehicle.

"LOW CONSUMPTION" GASOLINE TANK

IMPRESSED with the necessity for establishing a low fuel economy one of the competitors in a recent consumption test held in France fitted his vehicle with a false tank, containing gasoline in excess of the quantity permitted under the rules of the contest, and was highly complimented upon the very remarkable performance of the machine. The deception became known, and it is now being urged that in all future consumption tests the fuel tanks shall be exposed on all sides and shall be cut up immediately after the close of the competition.

The tank which gave rise to this scandal is of rectangular form, as shown, and is filled through the aperture O. It contains within itself a supplementary reservoir, *a, b, c, d, e, f, g,* made with the side *c e* inclined, so that the judge's testing rod introduced into the filling hole passed the inner tank anglewise, as permitted by the orifice O, and met with no obstruction. A small orifice is made at N, and above another at M, carefully hidden and made near a joint.

Before the start the judges filled the tank (the total capacity of which is fifty liters). The filling of the whole tank was easy enough, for when the spirit attained the level of the small orifice N it entered the false tank, from which the air escapes by means of the small hole M. The whole fifty liters having been poured in, the orifice O was closed and sealed. When the gasoline had fallen below the level of the hole N, and the contents of the



false tank had passed into the tank proper, some excuse was made to expose the top of the tank and surreptitiously seal the hole M which resisted the passage of air.

The distance completed, the judges came to fill up the tank afresh, and noted as the amount of fuel consumed during the journey the quantity they then introduced. But the false tank being full of air, which could not escape as heretofore by the hole M, the actual consumption was recorded less the cubical content of the false tank.

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Why Horses are Scarce

Analysis of Causes Which are Contributing to the Unpopularity of Draft Animals

FROM carefully compiled statistics it is evident that the number of horses which are being bred and imported annually does not keep pace with the growth of the population. This interesting fact, which has been apparent for some time past, is variously interpreted. Breeders and others of their ilk affect to believe that there would be no demand for automobiles if horses were plentiful. Maybe not. It is certain, however, that if automobiles were plentiful there would be mighty little demand for horses.

One can only conjecture upon the extent to which the use of the touring car and runabout has contributed to the decline of the horse. A cautious estimate of the number of automobiles employed in the service of pleasure puts the number at about 150,000. A statement going the rounds of the daily press, however, places the number at about 80,000. Manifestly, the last estimate is too low, as the product for the present year will likely reach 50,000 machines, while the product for last year was fully 30,000. There are the lean years prior to 1905 still to be reckoned with.

It is customary with people who but superficially observe the course of the power wagon movement to remark upon the evident scarcity of commercial motor vehicles, of which there are in all probability about 4,000 in use at the present moment in this country. The significance of these numbers, however, is considerably enhanced upon remembering that each machine has probably displaced three draft animals. Let us assume that in a city with a population of 500,000 there are 10,000 horse drawn wagons. If we preserve the ratio of substitution mentioned above a little more than 3,000 power wagons would perform their functions. Five hundred power wagons would not attract much attention in such a city, and yet they would have replaced one sixth of the horse wagons.

There are about 750 power wagons in the city of New York. The overwhelming preponderance of the horse drawn wagons causes the machines to be not particularly noticeable, and yet upon reliable authority we learn that they have taken the place of close to 3,000 horse drawn wagons. It is not, however, by matching the numbers of one class of vehicle with those of another that the progress of the power wagon movement is determined. The important facts to bear in mind are these: The power wagon is actually displacing horses; its use is spreading faster than its numbers would indicate to untrained observers; it is capable of being improved, which is more than can be said for the permanently inferior draft animal. The situation might be picturesquely described as a conquering march for the power wagon and a stubborn defense and retirement for the horse.

In 1902 the population of this country was about 78,000,000, the number of horses to every thousand of the population was 211. In 1905 the population was about 82,000,000, and the number of horses to every thousand of the inhabitants was 208. These statistics are set forth with much complacency by horse breeders and others interested in the retardation of the whole automobile movement. They find comfort in the fact that the decline of the horse has been so slight, but they overlook the extraordinary commercial and agricultural activity which has resulted from the growth of population within the years mentioned, and which according to all known laws of commerce should have stimulated rather than diminished the demand for horses.

The truth of the matter seems to be that labor saving devices of whatever kind—steam railways, electric railways, automobiles for pleasure, automobiles for business, stationary gas engines, motor farm machinery, etc., —are effectually robbing the horse of many important duties which till their introduction were as a matter of course performed by him.

MOTOR SPRINKLERS FOR BERLIN

MOTOR street sprinklers are to be employed by the city of Berlin. One vehicle, costing $4,000 will be delivered within a month. Others will be bought later in the year.

These municipal vehicles will have a tank capacity for 1,125 gallons and an automatic device for registering the quantity of water sprinkled. Comparing areas the city of Berlin spends more money on street cleaning than any other city in the world. At least this is the opinion of the director of the street cleaning department, who goes on to say:

"There is room for economy. Berlin's population exceeds two millions, but owing to the height of our houses—there are scarcely any with fewer than four stories—we get a comparatively small street area. The watering and cleansing might be done as effectively and more economically by means of automobile plant: at least I trust that our experiment will settle this satisfactorily."

MOTOR WAGON SERVICE IN AUSTRALIA

A COMPANY is being organized in Sidney, New South Wales, under the name of the Motor Carrier Co., Ltd., capital $500,000, with the object of importing tractors, motor wagons, and motor buses, and conducting the business of carriers and contractors in and around Sydney and such other districts as may be selected.

The postmaster of Boston has applied for permission to purchase one or two specially built motor vehicles to be used in mail carrying service.

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Motor Wagons for Farmers

Possibilities Which Lie in Co-Operative Purchase and Employment of Motor Vehicles

OFFHAND one would be inclined to say that a long time must necessarily elapse before agricultural producers can make the motor wagon available. The high cost of the machine seems to be an insuperable barrier to its wide use among farmers.

A little reflection, however, will show that the prospect it not nearly so distant as at first glance it appears. Co-operative buying, first advocated in England, has already made considerable headway, and in certain districts in the east, where large markets are conveniently located to farm lands, the desirability of employing motor wagons to haul fruits, vegetables and other food products has been actively canvassed of late. Speculation upon the utility and economy of motor vehicles in such service is helped by the following remarks from a foreign contemporary which has given considerable thought to the subject:

"In a very large number of instances the purchase of a motor wagon considered as a private speculation, would not be justified, owing to the work being insufficient to keep it fully employed. It is in these cases that the principle of co-operation comes into play. A number of farmers, fruit-growers, market gardeners, etc., by combining for the purchase of suitable vehicles, can run a regular motor service which will carry their products to town or railway stations with safety and expedition. The plan is one which is already meeting with no small measure of success, and we feel we are taking no great risk when we prophesy that, in the future, such services will be very important factors in the development of agriculture districts.

"We have it on the best authority that many of the great railways are only too glad to have reasonable requests for such services put before them, and when this plan is adopted, even the burden of first cost is removed from the shoulders of the producer. It is one of those cases in which nothing can be lost by asking; the request can only, at the worst, be met by a refusal. On the other hand, the saving of time in the collecting and transport of garden produce, fruit and the like, is of the greatest importance.

"In those instances where the producers propose to take the matter entirely into their own hands, and, by slightly increasing their risk, save the carriers' profit, there are many points to be considered. There is the question of whether the light, fast van, carrying, say one ton, and averaging fifteen miles an hour, is more or less suitable for the special purpose than the five ton wagon, moving its heavy load economically but at a much slower speed. There is also the problem of supplying the vehicles with a useful load for the return journey, for by so doing the cost of transport of goods per ton mile may be greatly decreased, and a possible failure turned into an almost certain success. There is also the question of the choice of vehicles which are well designed and built to stand hard work. These and other matters require careful consideration. But if it appears that motor vehicle transport can be economically accomplished the opportunity for acquiring it should not be permitted to pass for want of a little energy and initiative."

LOW FUEL CONSUMPTION

HAVING demonstrated during the recent commercial motor vehicle trials in France that its fuel consumption per ton mile was but .004 gallons the jury awarded first honors to the Latil avant-train. This train consists of a motor wagon with front wheels mounted behind the motor, and a trailer.

MILITARY MOTOR TRANSPORT

MUCH attention is being given to the subject of motor transport by the general staff of the Italian army. Trials are now being made with a military train composed of a motor wagon and several other vehicles as trailers. The trials are being watched by the chief of staff and are proving highly satisfactory.

The proprietor of the stage line running out of Vineland, N. J., has sold his horses and bought motor buses.

Motor bus service now connects Altus with Mangum, Oklahoma.

GOOD GOVERNMENTAL POSITION

CANDIDATES for the position of driver for the motor vehicle used by the U. S. Customs department in San Francisco were recently examined by the civil service commissioners. Eligibility was determined by the following requirements: Applicant to be at least 20 years old, experienced in operating gasoline cars of not less than 24 hp., familiar with the use of mechanical tools, and competent to care for the vehicle, make necessary adjustments of disordered parts, and effect minor repairs. The position is worth $1,500 a year.

The Automobile Transit company, of Milwaukee, which was recently formed for the purpose of operating motor buses between that point and various inland lake resorts, has filed its articles of incorporation at Madison. The capital stock is placed at $10,000.

Two electric motor buses, each seating 20 passengers, will soon be operating in the parks of Cleveland, Ohio, under a privilege granted by the authorities.

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Shortcomings of Drivers

The Economy of the Power Wagon Exists Despite the Inexperience of Operators

IT is absurd to charge the power wagon with the faults of its driver; to point to the shortcomings of the man as evidence of imperfection in the machine. As well deride the utility of the alphabet because schoolboys cannot spell.

It is the fashion of the hour to elaborate upon the difficulties which inexperienced drivers encounter in caring for and operating motor vehicles placed in their control. Mastery over anything in this vale of tears is not to be achieved without industrious study of the problems in hand. In the matter under consideration the supervision of competent executives is as necessary as instruction to the young.

These remarks are induced by the views of the writer who, in "Collier's," has for the second time considered the field and usefulness of the power wagon. He laments the difficulty of obtaining "perfectly competent drivers" for commercial vehicles. He might as well sorrow because the moon is so inconstant. Philosophers make the most of what they have. None of us are likely to live to see the day when the "perfectly competent driver" will be in the majority. Railroads, at the end of almost a century of practice, have not yet trained the mass of their engineers to more than ordinary proficiency, but are still far from quarreling with the products of the locomotive works.

It cannot too often be repeated that the economy of the power wagon is being demonstrated despite the shortcomings of operators whenever it is put to service for which it is well adapted and given a reasonable degree of intelligent stable care. It persists and makes friends, not because of the difficulties which ignorant employees experience in caring for it, but because of its superiority to their studied neglect.

"Collier's" writer exhibits the common fault of novices in attempting to assign particular spheres of usefulness to the two dominant types of vehicles—gasoline and electric. The electric wagon, he declares, is the most suitable for city delivery "on account of the simplicity of its driving apparatus which permits the employment of unskillful drivers." The lefthanded compliment undoubtedly was well meant. It is not on account of the simplicity of its "driving apparatus" that the electric machine holds its place in general esteem, but because of the long experience which has been had with it and the undoubted advantages to be derived from employing it in large numbers.

What the author describes as the "complex character of the mechanism of the gasoline vehicle" is, in his opinion, sufficient to justify only the employment of "skilled drivers" on wagons of this type. It would doubtless cause him much astonishment to know that the average driver of a gasoline wagon is not a whit better informed than himself. Such "skill" as he may possess can be imparted in a week or less by a competent instructor.

So much of the article as a prudent counsellor would have cautioned "Collier's" to print is here reproduced, omission being purposely made of the amateurish remarks on mechanical matters:

It is needless to enlarge upon the numerous advantages involved in the use of the automobile for commercial purposes, since its economy, durability, even efficiency, depend very largely upon the man at the wheel. It is difficult to obtain perfectly competent drivers for commercial vehicles. As soon as a man has thoroughly mastered the intricacies of the machine and its management, he will "graduate," as an extensive user of commercial automobiles expresses it. He considers himself above the duties of a cart man, and will be content with nothing less than driving a touring car. Very many of the extensive users of power wagons prefer to have chauffeurs who are sufficiently well trained merely to drive the wagons, being directed to report at once any disablement or breakdown on the road, and under no circumstances to attempt repairing even the simplest mishap.

The largest users of power wagons have adopted the plan of keeping regular classified accounts for each wagon, including such items as labor in driving, labor in repairs, time consumed in waits, time consumed in performance of duty, the number of trips per day, with mileage and tons weight carried, consumption of gasoline and oil, both in dollars and cents and in pints and gallons. All these items entered in the ledger give the total cost of maintaining each wagon. While this operation involves considerable labor in separately entering up all the charges involved in the care and operation of an automobile, it pays in the end, as enabling the owner to maintain a constant watch on the performance of the wagon, provide for the very best results in operation, and secure the highest return on his investment. Since the commercial automobile is, as the term indicates, a purely business proposition, the first point in which it must demonstrate its superiority to horse traction is in the lower cost of performing given tasks, be they miles covered per hour or tons weight hauled.

In comparing the expenses involved in maintaining one motor wagon, as compared with one horse wagon of similar drafting capacity, the superior economy is not apparent. Thus, according to the figures furnished by the Chicago Public Library, where account of expenses is figured down to the minutest item, the cost of a single gasoline wagon of one ton capacity averages between $130 and $135 per month. As against this showing, the horse wagons formerly employed in the same service averaged $115 per month. In both cases repairs and drivers' wages are included. This might seem on the face to indicate the inferiority of the motor wagon in point of economy. The truth is, however, that four automobiles easily do the work formerly requiring seven horse wagons and twenty-one horses. The total monthly expenditure then is a maximum of $540 for the automobiles as against $805 for the horses, representing a saving of $265 monthly, or $3,180 annually. Furthermore, in a day of eight hours one motor wagon can cover the distance of eighty miles at ten miles an hour, while the horse wagon could do no better than thirty-two miles at four miles an hour; the superior efficiency amounting to one hundred and fifty per cent for both speed and mileage.

As a general proposition a motor vehicle should have a working capacity between two and three times that of a horse wagon of its own class. According to the claim of manufacturers and users the average is nearer three than two.

Commercial vehicles are propelled by electric motors or by steam or hydrocarbon engines. The electric is the most suitable for local work, such as city delivery, on account of the simplicity

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of its driving apparatus, which permits the employment of unskilled drivers. It is largely unsuitable for long-distance work or for any run above twenty-five or thirty miles, on account of the necessity of periodically recharging the batteries. The gasoline wagons are, of course, capable of long-distance runs, and, according to the statements of numerous users, are equally suitable for local express and deliveries. Their only drawback is the complexity of their mechanism and the imperative demand for skilled drivers.

To the present date commercial automobiles have been most extensively used in local and short-distance work, particularly for city and suburban deliveries, and in the heavier forms for local trucking. While numerous tests have demonstrated the ability of well-constructed wagons to render efficient service in long-distance work, the matter is still in the experimental state.

Briefly expressed the fundamental difference between highway and railroad locomotion is the absence of any constant operative condition. The railway locomotive, although employed for drawing loads of all weights at any speeds found suitable in given conditions, travels upon a track of steel rails whose physical conditions are constant. The road motor, on the other hand, must not only carry loads varying from the greatest to smallest weight, but also travel over every kind of road surface from an asphalt or wood-block street to a mud or deep-sand trail. This sort of thing inevitably complicates the designer's work, since he must be able to devise some means for accomplishing the ends of easy riding, such as will carry merchandise without injury, and good tractive qualities to suit ever-varying conditions. Experience warrants the statement that both the riding and tractive qualities of a motor wagon are the best under heavy load, even on poor roads and in snow. The problem, therefore, is largely the demand for some form of compensating devices that will prevent injurious vibrations while running under light loads or on heavy roads.

LEST WE FORGET

ENEMIES of the gasoline vehicle, whose numbers increase as its success becomes more pronounced, are fond of dwelling upon the alleged unreliability of the motor and contrasting it unfavorably with the dependability of Dobbin. It is a fact, nevertheless, that there is a larger percentage of sick and incurable horses than there is of deranged and chronically ailing machines. It is of more importance, however, to remember that the causes of disorder in a well designed motor can always be ascertained and remedied, which is more than one can say for the troubles to which horses are heir.

The balky motor is anathema among horsey people. It is always a text for a sermon on the superior reliability of the draft animal—save the mark. It never occurs to these hostiles to consider that mechanical troubles, however irritating and unexpected, are as sure to be remedied by skill as they are to be produced by ignorance.

But what about the balky horse? What is the cause for its disability? What the remedy? And when by pure accident it is found who, from David Harum back to the first horse trader, has been able to disclose the physiological action it involves. It is a miracle when a balky animal is restored to motion. It would be a miracle if a machinist could not discover and repair the fault of an engine.

Perhaps you don't believe that sorcery has to be exercised in overcoming the helplessness of a balky horse. Well, read this from an authority on the subject:

Some years ago in Cincinnati, during the noon hour, in one of the busiest streets, a horse attached to an express wagon became balky. Many remedies were tried without effect. Presently one of Cincinnati's best known horsemen came along. When he saw the trouble he smilingly asked for a stone, which was given to him. Then he asked the driver to lift up one foot of the horse, and with the stone he struck the shoe a number of times.

"Now," he said to the driver, "get up on your seat and drive off."

This the driver did, amid the cheers of the bystanders. The horseman said he had no idea why this made a balky horse go, but he had found it an unfailing remedy.

There you are. A conjurer's stone and confessed ignorance of its virtue, on the one hand; on the other, the principles of mechanics and their well understood application. Which is the more unreliable?

HIGH OFFICIALS ARE INTERESTED

IT is being publicly advocated by Italy's minister of finance that the state should undertake to maintain motor services for postal, passenger, and goods traffic where there are no railways. He urges that the revenue duty on gasoline be reduced when the spirit is intended for motors.

A motor bus line will soon be operated between Bryan, Texas, and Covege Station. The vehicles will carry 16 passengers.

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Portland Rd Stn. & Hyde Park Corner
Oxford Circus and Sloane St.
Hyde P. Cor & Kensington Church
Sloane St. & Earl's Court Road
Exhibition Rd. & Addison Rly Bdge
Kensing. Ch & Hammersmith B'dwy
Earl's Court Road & 'Greyh'und,' Fulham
Addis'n Rly. Bdge. & Fulham Cemetery Gates
Hammersmith Bro'dway & Fulham Road
'Greyhound' Fulham, & Putney Ch.
Fulham Cemetery Gates & Putney Section
Putney Sta. & Fulham Cemetery Gates
Putney Ch. & Greyh'nd Fulham
Fulham Rd & Hammersmith Broadway
Fulham Cemetery G. & Addison Rly. Bridge
Greyhound Fulham, & Earl's Court Road
Hammersmith Br'adway & Kensington Ch.
Addison Rly Bridge & Exhibition Rd
Earl's Court Road and Sloane Sq.
Kensington Ch. & Hyde Park Corner
Sloane St. and Oxford Circus
Hyde Park Cor. & Portland Rd. Stn
Oxford C. & 'Britannia,' Camden Tn.
Portland Rd Station and 'Shipton,'
Kentish T'n.
'Britannia,' Camden T. & 'Mansfield' Gospel Oak

London Motor Bus Ticket.

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Heavy Vehicle Traction

Last Article on the Importance of Good Roads for Heavy Motor Vehicle Traffic

(By Lieut. Col. G. Espitalier)

THE price of fuel has an important bearing on the prospects of commercial transport, and also economic efficiency. In this respect the last exhibition showed signs of great improvement. In the omnibus section, the 24 hp. De Dion, for more than 30 passengers, consumed 0.470 liter of gasoline per kilometer; the Brille 0.400 of carburetted alcohol; that is about 0.02 per hp. in both cases. In the regulations for the military wagon competition, held simultaneously, there was a very interesting clause saying that it would be desirable to employ kerosene, gasoline, alcohol, carburetted or not, in the same motor. This possibility would greatly facilitate the obtaining of supplies in different countries according to their resources. Several of the vehicles exhibited had motors of this adaptable type.

Such is a brief sketch of the difficulties in the "heavy weight" problem, and the endeavors made to conquer obstacles. Before concluding I must say a few words about road trains, which, though not always applicable, meet special requirements. They will come midway between the motor lorry and the tramway. For military purposes road trains are also the best for the rearguard transports on campaign.

The lamented Col. Renard invented a type of train, easily driven, and running with marvelous pliancy, even in the most crooked streets, with a train of ten to fifteen wagons. This is because all the wagons follow exactly in the track of the tractor, describing the same curves at the same points. All these advantages are due to the two fundamental principles upon which the system is based—continuous propulsion and accurate turning. By continuous propulsion, I mean that each wagon moves of its own accord, the rotation of its driving wheels being governed from the tractor by a shaft divided into as many sections as there are wagons; the sections are connected by universal joints. The tractor has not to exert a traction stress: it is merely a works in which power is produced to be distributed to each wagon by the shaft. There is a gain in being able to lighten the tractor, as it then only needs adherence for its own propulsion.

Thus, all the wagons move at the same speed, provided that their wheels have the same radius and their couplings are not strained. They must be guided in the track of the tractor, which is done by the aid of the accurate turning device; this consists of a coupling bar hinged at one end to the pin of the steering carriage in front of one of the wagons; at the other to the draw-bar of the wagon in front. It becomes necessary to lengthen the rear of each wagon behind the underframe. Nothing could be simpler, but we pass in silence over many difficulties which Col. Renard had to conquer to make the system practical, which he did with that great ingenuity which gives such great value to all his inventions.

It is a delicate and difficult matter to draw conclusions from what precedes. I have dwelt at length upon the difficulties of the "heavy weight" problem, and have demonstrated the many obstacles to finding a definite solution. After this attack of pessimism, however, I alluded to all kinds of vehicles, from the delivery van to the heaviest lorry, performing an extremely difficult trial, running almost continually for more than eight days on difficult roads, which is a sufficient proof of their endurance, solidity of the mechanism, and the sureness and regularity of their running.

As regards delivery vans, the type seems definitive, and they are utilized by all large business houses. The future will bring further improvements in wheels, tires, and the economic efficiency of motors.

A French manufacturer stated that he found horses preferable to motors for short journeys with frequent stoppages, but that, when the question is of regular or irregular transport of heavy goods for long distances, where speed is a matter of consideration, the motor wagon has no rival.

It is astonishing that the motor omnibus has barely won its rights of citizenship at Paris, as in other capitals. However, lost time will be made up for. The Paris General Omnibus Company has wisely decided to adopt motor buses on the more difficult parts of its system where extra horses are needed to ascend the heights of Clichy and Monmartre.

There remain the lorry and dray, which are not yet perfectly satisfactory, perhaps owing to the weight, which increases all the difficulties; but, if we consider the progress made since 1897, we can guess what the future has in store. Even though there may not yet be strict economy in operation, manufacturers still have the advantage of being able to double their field of action and to increase business relations. An outward trip of 25 miles is easily travelled by a motor wagon, which horses could not do without relays. Moreover, with a single driver, there is a continuous service—except meal times—of 10 hours daily, during which time, owing to the greater speed, four times the number of customers can be visited. These are sufficient reasons to open the gate to all hopes and thus complete the vast system which will make it possible to carry merchandise to the most remote places.

RAILWAY OFFICIALS TAKE ALARM

STREET railway officials in Edinburgh, Scotland, are perturbed over the imminent appearance of 30 motor buses upon the streets. They declare that the vehicles are not needed. The city authorities, which operate the street railways, seek to show that the authority to "regulate the traffic" implies the right to prohibit the employment of motor buses.

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Their Attention

A LEAK in the circulation of the cooling system is easily remedied if taken in time. Neglected, such a leak will cause the wagon to spill a pool of water every time it stops and so commit a nuisance hardly less reprehensible than dripping oil. A turn or two of one of the unions is usually enough to stop the leak. This should be done to all the unions on general principles once in so often, as the rubber or leather washers which make them watertight gradually wear away, and the wear should be taken up. If tightening fails to correct the trouble the only thing usually needed is a new washer. The same remarks apply to the glands of the stuffing-boxes on the pump; they require taking up occasionally. If the pump still persists in leaking new gaskets are required. Unless the wagon has been unduly strained or been in collision, there will seldom be anything amiss with the cooling system other than the trivial and easily remedied defects just noted. It is surprising what a quantity of water will leak through an outlet that does not permit the passage of more than 20 or 30 drops a minute.

Defective Trembler Springs

Sometimes it will be found, after the wagon has been in use for a long period, that one of the cylinders is missing, and the fault will be traced to the trembler. This may be carefully adjusted to give a most inspiriting buzz, and it may be found when the plug is taken out that it sparks beautifully, and yet the engine will refuse to run on this cylinder when the other tremblers are held down. This does not often occur, but if it is found impossible by ordinary adjustment to persuade the cylinder to fire, the spring holding the free blade of the trembler should be examined. The trembler should be moved up and down very carefully to see whether the spring is as strong as the springs of the other cylinders which run all right. It will probably be found that the spring is weak; not so weak as to prevent continuous buzzing when the particular plug connected with it is in circuit and the engine stationary, but sufficiently dead to prevent the quick break which should occur to ensure sparking when the engine is running. This can be remedied by cutting a little off the spring, so as to make it somewhat stronger.

On Change Speed Gears

If gears are made of metal of good and suitable quality, if the teeth are correctly cut, and particularly if they are reasonably handled, no trouble should be experienced with the ratio reducing or differential gears. It is necessary to look carefully after the lubrication, and see that the gear cases are kept properly charged with gear oil or grease, according to the mandate of the maker. In addition, the gears should be carefully inspected every 1,500 to 2,000 miles, to do which it will be necessary to empty the gear cases of oil and flush them with paraffin till they are quite free of lubricant, and the condition of the gear wheel teeth can be easily perceived. Should any of the wheels or toothed rings show signs of abnormal wear, and prove to be in a condition likely to bring about fracture under any more than ordinary stress, they should be replaced, or they may break up at some unexpected and most undesirable moment and ruin the whole gear. If such attention is given to the gearing it will always run sweetly and quietly, lacking that ear-offending noise which is audible evidence of neglect.

Lubricating Pumps

Often it is difficult to quickly force lubricating oil from the pump to the engine bearings or to the crank case, this being due to either too small a delivery hole in the tap fitted to the bottom of the pump or too small a delivery pipe. The remedy is obvious.

MOTOR STREET SWEEPER

THE motor street sweeper shown in the accompanying illustration was made in France and recently tested with success on the streets of Paris. The rotary brush is carried angularly. Its top half is covered by a hood to prevent the dust from rising. As a further precaution a sprinkler is carried in front of the brush, which dampens the surface of the road. As a still further precaution an additional sprinkler is carried at the rear of the brush.

In the body is a 450-gallon water tank. The brush is driven by chain from a countershaft crossing the car angularly beneath the seat. The drive is from a jackshaft in front of the rear axle by shaft and bevel gears.

The engine develops 12 hp., has two cylinders, is carried beneath the seat and connected by clutch with a three-speed and reverse sliding gear transmission. The forward speeds are 5, 7 1-2 and 15 miles per hour. If the brush is not required it can be elevated and thrown out of gear, permitting the machine to serve as a sprinkler.

Wood wheels with steel tires are fitted.

Two more rural mail routes are now being covered by automobiles—one beginning at Janesville and the other at Orfordville, Wis.

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SUCTION GAS PLANTS

THERE is more hope for users of internal-combustion engines in connection with heavy vehicular road traffic from suction gas plants than from alcohol. Much as we should like to be able to regard the possibilities of alcohol as coming within the range of practical politics, we are obliged to confess that the necessary minimum cost in England cannot be made sufficiently low to enable this fuel to exercise an effective and useful control upon the price of gasoline.

The Royal Agricultural Society of England has this year conducted a series of trials for these plants, with engines ranging from 15 to 20 hp. We discern, here, the beginning of developments which may lead to the introduction of internal-combustion engines with suitable suction gas accessories designed to be accommodated in lorry or omnibus chassis. It has already been stated in our columns that experiments are being conducted to bring about the introduction of such systems, and success will confer the enormous benefit of cheap power upon road traction undertakings.

The evolution of a suction gas plant capable of convenient disposition in the frame of a road vehicle, which would not add undue weight to the structure, and whose parts would not be prohibitory for any other reason, might readily enough bring down the best of our present energy charges in motor bus operation by at least 60 per cent. The prospect is, while by no means ignoring the difficulties yet to be overcome, a most alluring one.—*The Commercial Motor.*

SEE THE GREAT WHITE LIGHT

THE public is familiar with achievements in mere speed of passenger carrying motor driven cars; but the freight hauling power wagon is as important. In this, moderate speed, together with durability and carrying capacity, are the essentials.

It is more than probable that the use of motor cars for the heavy draying of cities will displace more horses than will the use of the touring car or runabout. Their greater capacity, hauling from six to ten tons at a load, will thin the streams of traffic, by decreasing the total number of vehicles in the street at any given time, while their moderate speed, incident to economical operation, will prevent them from becoming a danger to pedestrians. Their development as a clean, sanitary, safe and cheap mode of internal transportation, will add to the comfort and the general desirability of city life.—*Columbus Dispatch.*

Information For Buyers

SEVEN TON TRUCK.—The Council Bluffs and Omaha Transfer Co. has purchased a 7-ton gasoline truck made by the Four Wheel Drive Wagon Co., of Milwaukee, which in addition to carrying its own load is expected to pull a trailer carrying five tons. The wagon will make four trips daily across the Missouri River.

A PROBLEM SOLVED.—The Vinton Co., one of Detroit's largest and most progressive building and interior finishing companies, swung in line and bought a motor truck. One of its officers says: "The problem of rapid transportation of material in cities is one which has worried the management of most large companies. The rapid growth of the city and the necessity of making long hauls to outlying districts has created the necessity of having some quicker service than is possible to attain with horse-drawn trucks. This caused us to look about for some means of relieving this condition, with the result that we have adopted the motor truck, and find that it easily does the work of three or four horse-drawn trucks. By this method of delivery of material we are able to please our customers and avoid keeping workmen waiting for material. We find the motor truck can make a round trip to outlying districts in 50 minutes, which would require a half-day for a horse drawn truck. It is our aim to keep abreast of the times and adopt methods, not only in transportation of materials, but in the production of it, which will give our customers the best possible service, and we believe that in the motor truck we have found the method for the delivery of material which is destined to take the place of horses and solve the problem of rapid transportation of material in cities." The truck was built by the Reliance Motor Car Co., of Detroit.

A SIGNIFICANT CHANGE.—George W. Bennett, generally regarded as one of the ablest sales managers in the automobile industry, has resigned from the Thos. B. Jeffrey Co. to take charge of the sales department of Knox Automobile Co., of Springfield, Mass., which latter concern was among the first to make motor trucks in this country.

ELIMINATING ERROR.—W. G. King, mechanical engineer, who for the past nine years has been manager of the Iroquois Iron Works, Buffalo, N. Y., is now associated with the James Macnaughtan Co., who, as sales agents and engineers, have exclusive control of the electric vehicle products of the following factories: the Rech-Marbaker Co., Philadelphia; the Pittsburg Motor Vehicle Co., Pittsburg; the Brunn Carriage Works, Buffalo. These last mentioned concerns are prepared to design and construct electric commercial and pleasure vehicles especially adapted to the use for which they are intended. So many vehicles have been made and put into operation which had merit in themselves, but were never suited to the work they were given to do, and so many errors have occurred which have marred what otherwise would have been decided advantage in economy and efficiency to the owner, that the James Macnaughtan Co. combine the selling and the engineering, with a view to eliminating such errors.

LATE CHICAGO RECRUITS. — Several Chicago concerns have purchased wagons from the Kansas City Motor Car Co., of Kansas City, Mo. The Cable Piano Co. has bought two, one with 3,000-pound capacity and the other with a load limit of 1,800 pounds. Sears, Roebuck & Co. have ordered a 6-ton truck, which has a 60-hp. motor. M. O'Brien & Sons, dealers in art goods, have ordered a light wagon and Spielmann Bros. Co., vinegar manufacturers, have purchased another.

THREE TON MAIL WAGON.—The Knox Motor Truck Company, of Springfield, Mass., is building a 3-ton gasoline mail wagon for the Mexican government, to be used by the post office department of the city of Mexico.

THREE TON MILK TRUCK.—The Wisconsin Condensed Milk Co. recently purchased a three-ton gasoline truck from the Knox Motor Truck Co., of Springfield, Mass., for service in New York City.

"Climax" Commercial Car
PRICE $900.00
HINDE & DAUCH
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Pressed Steel Truck Frames
The
PARISH & BINGHAM CO.
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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

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WALTER WARDROP, EDITOR AND PUBLISHER

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Municipal Wagons

Economy and Variety of Service Yielded by Vehicles Owned by City Corporations

(Special Foreign Correspondence)

BEFORE proceeding to a consideration of the gasoline vehicles used by British public authorities it will not be out of place to present figures showing the comparative cost of running steam wagons and horses for refuse collection as obtained by John M. Brodie, the Liverpool city engineer. Mr. Brodie employs six steam wagons. His experience with them dates from the first practical beginning of mechanical road traction in England, as distinct from traction engine or road locomotive haulage.

The experience which Mr. Brodie has acquired from the use of steam wagons will form the basis of comparison for the employment of gasoline vehicles for refuse collection and similar heavy work in Great Britain. He places the annual outlay for each vehicle at $1,950.82, but remarks that in the case of a new and up-to-date vehicle the item for repairs, included in that sum and mentioned below, and the sum for renewals might be taken at $480, a reduction which will bring the annual outlay per vehicle down to $1,470.82, or $52.80 less than the figures given in the last issue of this paper as the annual average charge on a 5-ton municipal steam wagon.

Annual Charges on Five-Ton Wagon

Mr. Brodie's details of annual charges per vehicle are as follows:

Repairs, including renewals	$ 656.96
Wages of driver and assistant, including proportion of night men at depots	602.86
Fuel, oil and stores	269.20
Interest 3½% and sinking fund at 10% based on life of 10 years.	303.00
Sundries, including insurance, establishment charges and contingencies	118.80
	$1,950.82

In our figures given last week we only allowed for a life of just under 7 years, fixing depreciation at 15% per annum. It is satisfactory to note, therefore, that after several years' experience Mr. Brodie is convinced that his vehicles will have a greater longevity. They average 245 days' work each per annum, thus leaving a wide margin of slack days during which the vehicles, if working, would be adding to the economy.

Superiority over Horses

The average time occupied in loading the Liverpool steam wagons is 80 minutes for each—the load on the motor being 9,500 pounds and on the trailers 5,150 pounds. Each wagon makes four journeys daily and occupies 30 minutes running to the refuse destructor, 18 minutes tipping, and 27 minutes traveling empty. Each round, therefore, takes an average of 155 minutes. One horse and cart will only perform three rounds daily, taking 80 minutes to load with 3,400 pounds, 58 minutes for the trip to the destructor, 15 minutes to tip and 50 minutes on the empty journey, a total of 203 minutes.

The steam wagon in 10 hours and 20 minutes collects 58,400 pounds of refuse and disposes of same, while a horse and cart requires 10 hours and 6 minutes to collect and dispose of 10,200 pounds. As a matter of fact the steam wagon and trailer sometimes carries a load of fully 8

Comparing Horses With Motors

The following comparison of costs gives an accurate idea of the economy of motor vehicles in Liverpool over various distances.

Distance in Miles	Number of Horse Loads	Total of Horse Loads in Tons	Number of Motor and Trailer Loads	Total of Motor and Trailer Loads in Tons	Cost Per Ton by Horses	Cost Per Ton by Motor
2½	3	5¼	4	29⅛	$0.41½	$0.27
1¾	4	6¾	4½	33	.33	.24
1½	5	8½	6	44	.26	.18
1¼	6	10⅛	6	44	.22½	.18
1	7	12	6	44	.18½	.18
⅞	8	13	6	44	.17	.18
¾	9	15¼	6	44	.14½	.18

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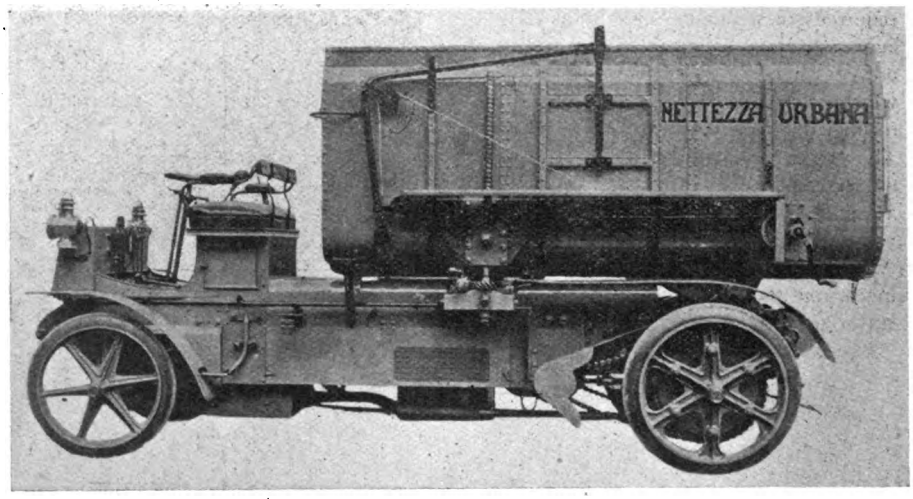
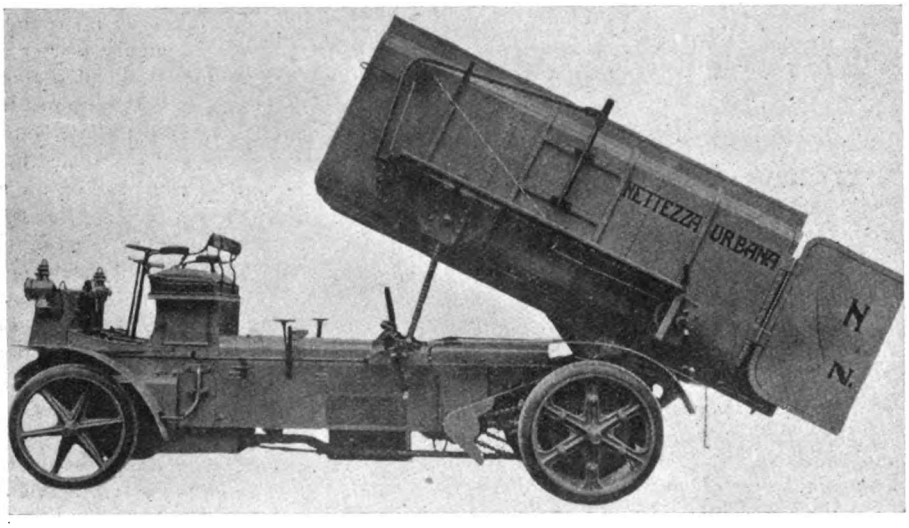
tons. The average distance of each round, whether by horse or motor, is 4½ miles. The cost of the motor per day we have already found is $7.92, or 34 cents per ton. The cost of carting by horse and cart is 42 cents per ton, according to Mr. Brodie's figures, which of course are absolutely accurate.

A Perfect Organization

It will have been noticed that the organzation in Liverpool is so perfect that it takes no longer to load a steam wagon and trailer with 8 tons of refuse than it takes to load 1¾ tons of similar material in a horsed vehicle. The unloading of a motor and trailer takes a little longer than the same operation with a horse and cart. A great gain is made by the motor and trailer in journeying loaded and empty. This is, of course, due to the superior speed of the motor, which consequently can cover a far greater area than horses, with the result that refuse is brought into Liverpool from greater distances and in greater quantities than before the motors were employed.



Municipal Four Ton Steel Dust Wagon Used in Rome, Italy.



Steel Dust Wagon Tipped.

As there is little to be gained by using the motors on the very short routes horses are mostly employed thereon. The motors are kept on the 3-horse load routes as long as there is sufficient work for them; otherwise they are placed on as long distance journeys as possible. Some time might be saved the motors on the short distances if whenever possible they worked in concentric circles, on the plan we have previously suggested, leaving trailers to be loaded while the loaded wagons and trailers are being taken to the depot and brought back empty, the empty trailer being dropped where it could be loaded while the motor proceeds to load and pick up the other trailer.

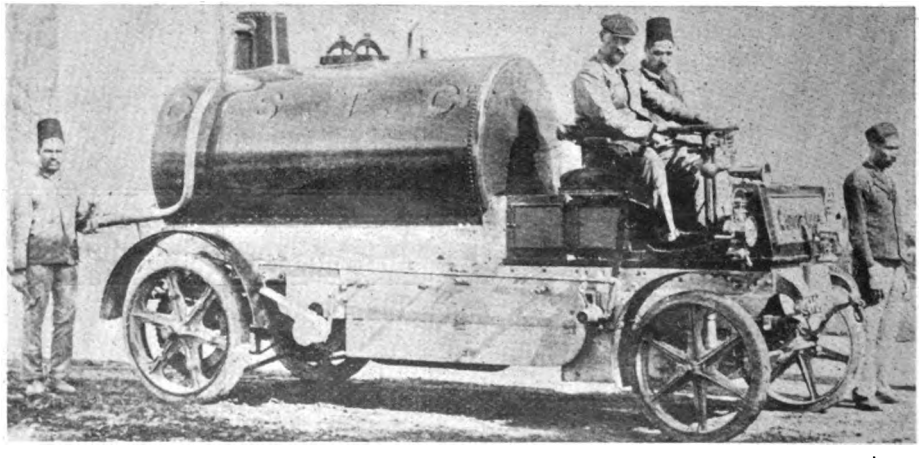
Economy of Motor Sprinklers

With regard to street watering there is a greater analogy between the gasoline and steam vehicle, where continual employment can be found, than in the case of collecting street and house refuse. The initial outlay on the gasoline vehicle is heavier, but its cost of operation is somewhat less. Mr. Brodie has published the figures giving the cost of watering by horse and motor. His steam water cart sprinkles a 32 foot road in one operation, whereas a horsed cart only sprinkles 16 feet at a time. The wide spread of the motor cart is obtained by mounting the tank high, or by using a lift pump to keep the head constantly at a level greater than the natural fall from the level of the water in the tank. The motor, therefore, has only to cover half the mileage performed by horsed vehicles in watering a given area. The motor travels at 6 miles per hour, while the horses travel only 1½ miles per hour. One motor accordingly displaces 8 horses.

Working in two shifts of 10 hours each per day, the Liverpool steam water cart covers 35 miles, equal to 656,000 square yards. Eight horses would cover between them 64 miles, but, as they would have to go over the road twice to water them effectively from side to side, the effective mileage watered would be just half the combined total distance run. Where, as on asphalted roadways, only the gutters are watered, there will be some loss of advantage of width of spread by the motor, but this is negligible because the whole width of the road has to be watered at intervals throughout the day.

Proof of the Motor's Superiority

On the Liverpool basis of $7.92 per working day of 250 days per year for running and other charges of a power wagon, the cost of watering a mile of 32 feet wide road is 45c. by power wagon and 55½c. by horses. The power wagon, owing to its greater load capacity, has to make fewer stoppages at the hydrants for filling up, a process which takes somewhat longer than is



Municipal Sewage Wagon Used in Cairo, Egypt.

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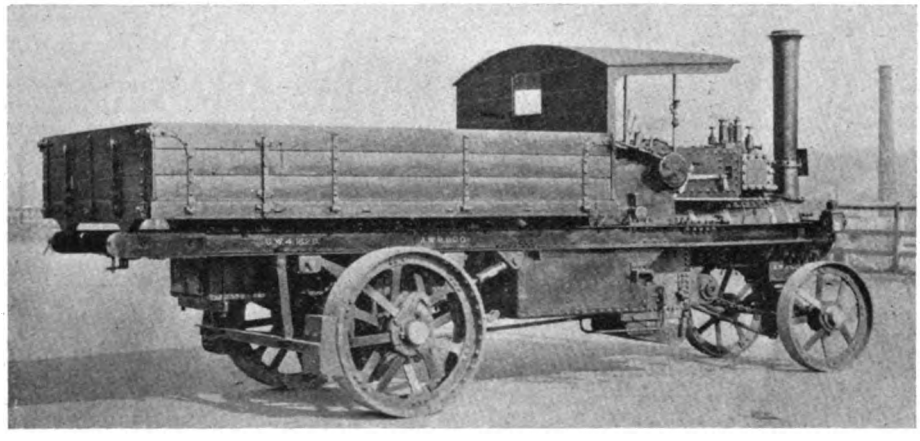
required for a horsed water tank; but the aggregate time during the day for filling the power wagon is less than the total time which would be required by horsed carts to fill with water to sprinkle the same area. The power wagon further economises time by requiring only an average of 10 minutes as against 30 minutes required by horses to run from the depot to hydrant for water. Another 20 minutes is also saved by the motor on the return journey, as well as six or seven minutes gained while distributing each load and returning empty.

Egyptian Municipal Motor Wagon

We illustrate a gasoline motor water cart or sewage wagon employed successfully by the municipality of Cairo in Egypt. The tank will carry 4 tons of liquid. When used for collecting sewage a steam apparatus produces a vacuum for inodorously emptying cesspools. The tank can be filled in two or three minutes. The gasoline motor has two cylinders, horizontally fixed, and develops 22 horse power. Four speeds forward and one reverse are fitted to the machine, which has solid rubber tires on each wheel. The highest speed possible is ten miles per hour. When used as a water cart any desired sprinkling apparatus can be fitted.

Van Operated by Bradford Municipality in Connection with Street Railways.

Illustrations are also given of another municipal vehicle—a sheet steel body tipping cart driven by a 20 hp. two cylinder horizontal gasoline motor. Four speeds forward, highest 10 miles per hour, and reverse are provided as in the water cart, and solid rubber tires are fitted to the wheels. The machine works in Rome, Italy. For discharging the contents the body is pivotted transversely and is actuated by the special screw tipping gear fixed on the near side, by which the entire body can be inclined to an angle up to 35 degrees. The load can thus be shot immediately out at the back, and for this purpose a door is arranged at the back of the body. A small pivotted crane, it will be noticed, is fitted at the near side of the wagon and is used for lifting the dust bins from the street, being operated by an atttendant shown on the platform. When not in use the crane can be folded down as represented in the view.



Five Ton Steam Lorrey for Municipal Work.

The Thornycroft gasoline water tank, also depicted, has a carrying capacity of 2 tons, and is fitted with a 4-cylinder vertical gasoline motor developing 20 hp.

(To be continued.)

Thornycroft Municipal Watering Wagon—Capacity Two Tons.

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Army Trials Abandoned

Invitation to Power Wagon Makers to Participate in Maneuvers Brought no Responses

DOUBTLESS the quartermaster general of the army feels that an affront has been put upon him by the manufacturers and agents to whom he vainly appealed for co-operation in an attempt to demonstrate the usefulness of the power wagon in military transport, during the course of the summer maneuvers. Had he taken counsel with people who were competent to render advice, he would either have abandoned the project before its failure led to humiliation or set about its accomplishment in a spirit a litle less humble than appears in the official invitation issued by one of his aides.

A friendly counsellor would certainly have warned him against the employment of such a decoy as Captain F. P. Avery for the furtherance of his well meant but grossly misconceived design. Avery used the columns of a contemporary to let it be known that "the prize to the winner is without doubt one of the greatest inducements ever held out to a manufacturer in this country, for there is no question that the auto-truck that enters this trial and performs the services required of it will be adopted as a part of the regular equipment of the United States Army, and when that happens the fortunate builder would better hurry home and enlarge his plant."

This clearly implied that some sort of decisive test was to be made of the wagons which it was expected would be placed at the disposal of the quartermaster general. But as that officer was explicit in declaring that the service of all wagons was to have been requited by the payment of so much for every ton of freight handled, and did "not recommend that any vehicle for this freight transportation be purchased at this time," the captain is under suspicion of having resorted to questionable tactics in order to unnaturally stimulate competition among power wagon makers.

The official invitation to manufacturers is a document which breathes profound caution. It is full of contradictions. It inspires and discourages. Its offer of compensation for service is ridiculous. The only redeeming feature about it is the liberality manifested in not confining the trials to the employment of any single type of motive energy. The more it is studied the more it becomes evident that the war authorities need rudimentary enlightenment upon the subject of mechanical traction. Advantages to be presently derived from the employment of power wagons are obscured by hazy thoughts of "prospective values" and "more or less definite determinations" to be gained from actual experience. It is small cause for surprise, that, with such feeble encouragement as the invitation afforded, manufacturers who chanced to receive it turned to other and more substantial work and so missed the fortune which the sanguine Avery so temptingly dangled in front of them.

This was the invitation:

WAR DEPARTMENT.

QUARTERMASTER GENERAL'S OFFICE, WASHINGTON, D. C.

Sir: In connection with instructions of the War Department for the maneuvers during the present summer I have the honor to submit the following:

From time to time there has been much discussion in military circles as to the relative value of mechanical traction engines and animal motive power. In order to afford the advocates and manufacturers of automobile trucks and mechanical traction engines an opportunity to practically test their value in military operations, I recommend that, as in the movement of troops of regular army the coming summer the infantry will be required to march 200 miles and the cavalry 250 miles, each way, the quartermasters contracting for such transportation service as may be necessary to accompany the troops be authorized, under proper restrictions from this office, to contract for automobile truck and traction engine service, provided it can be obtained at reasonable rates.

While it is not believed that automobile or mechanical traction power can ever be made the chief reliance of the army operating in the field, at the same time it is believed that if the builders of such vehicles are given the opportunity, under such conditions as are proposed, during the coming summer, valuable points can be developed and the prospective value of such means of transportation be more or less definitely determined by actual experience.

It is recommended that no limitation be placed upon the kind of motor or motive power to be used in this service, but that any manufacturer or owner desiring to enter the field be invited to submit suitable propositions for furnishing one or more trucks together with the necessary personnel and fuel to provide the needed transportation.

It is believed that this will at least afford a beginning in the matter of experiment with this class of transportation.

It is not recommended that any vehicle for this freight transportation be purchased at this time, but that they be chartered or hired to carry their loads at so much per ton mile, the details to be submitted to the quartermaster general; if he approves of the general scheme herein proposed, the chief quartermasters of the divisions be instructed as to the manner of employing such transportation.

It is believed that the opportunity will at least be afforded all persons interested to enter the field in an experimental way.

June 13, 1906.

ASSISTANT QUARTERMASTER GENERAL.

One will vainly scan the list of concerns which received copies of this invitation for the names of many reputable and responsible establishments which, in the event that the war department knew what it wanted, could execute large orders. Many firms which were actually bidden to participate in the maneuvers never even contemplated the manufacture or sale of a power wagon. Some of them are so obscure as to give rise to the suspicion that the quartermaster general was the victim of a practical joker. Naturally enough no aid was forthcoming for the trials. Invitations were sent only to the following firms:

C. W. Motley, automobile livery, 344 Michigan Avenue, Chicago.

Green Motor Car Co., 1421 Michigan Avenue, Chicago.

Heidelmeir Automobile Station, 3210 N. Clark St., Chicago.

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C. A. Coey & Co., 1322 Michigan Avenue, Chicago.
Branstetter Automobile Co., 1466 Michigan Avenue, Chicago.
Buick Motor Co., 1412 Michigan Avenue, Chicago.
Electric Vehicle Co., 1332 Michigan Avenue, Chicago.
Pardee-Ullman Co., 1218 Michigan Avenue, Chicago.
Reo Automobile Co., 1323 Michigan Avenue, Chicago.
St. Louis Motor Car Co., 1229 Michigan Avenue, Chicago.
The Winton Motor Carriage Co., 1255 Michigan Avenue, Chicago.
Woods Motor Truck & Vehicle Co., 1418 Michigan Avenue, Chicago.
Locomobile Co. of America, Michigan Avenue and 14th St., Chicago.
The Cadillac Automobile Co., 1312 Michigan Avenue, Chicago.
Chicago Automobile Mfg. Co., 3212 State St., Chicago.
The Chicago Moto Cycle Co., 536 Wabash Avenue, Chicago.
Western Motor Truck & Vehicle Co., 27 S. Clinton St., Chicago.

Mournfully an aide of the quartermaster general informs us that as no responses have been received to the invitations issued, the maneuvers must proceed without the service of power wagons. Perhaps it is just as well that the matter should have ended as it has, for the trials could have resulted only in the war department becoming convinced that vehicles well adapted to commercial work are not necessarily desirable for military service. When power wagon manufacturers have more leisure, or when their work has become more highly specialized, they will doubtless be eager to demonstrate to the army authorities that the economy, utility and efficiency which is observable from the employment of motor vehicles in commerce can also be shown in vehicles designed for military purposes.

MOTOR RURAL MAIL DELIVERY

AT first glance it would seem that rural mail carriers could not, out of their small salary, afford to keep an automobile for conveying them on their rounds of duty. Nor could they if the first cost of the machine, or its subsequent maintenance, was unduly high.

There are other matters to be considered, however, than the mere investment. Nearly all carriers, for example, are obliged to keep two horses, the daily trip of 25 or 30 miles soon telling upon an inferior animal. In such cases it is fair to assume that $250 is sunk in horseflesh and $75 more in a wagon. Feed, shoeing, wagon and harness repairs, and other items of expense are, of course, not so costly as in a large city, but nevertheless they will total, for a two horse outfit, at least $25 a month, or $300 a year.

As rural carriers are only paid $600 a year one-half of their salary goes to pay for the transportation of the mails.

Naturally, therefore, the economy of a low priced machine, if its superior speed will give them liberty for other employment than mail delivery, appeals to their business instincts.

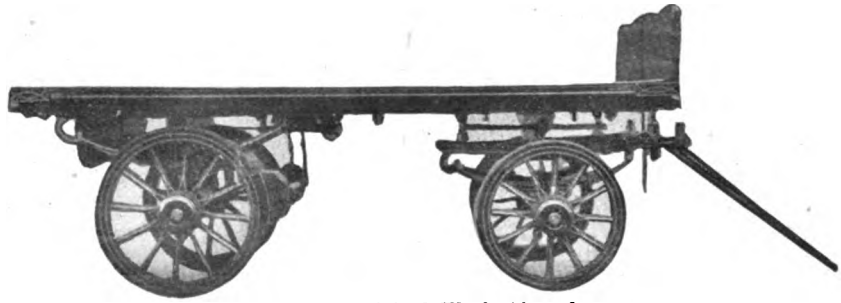
The maintenance of such a machine as was recently successfully demonstrated in rural postal service would, barring accident, never be likely to exceed $200 a year. If, then, the machine was placed in the carrier's hands at $400, as we are led to believe will be done should the postal authorities sanction its employment on well-surfaced routes, the investment would be but slightly higher than at present while the cost of maintenance would be considerably lower.

Besides, there is the prospect that the salary of rural mail carriers will be increased either to $800 or $1,000 a year. In the event that the latter figures should be decided upon the purchase of a machine would be much simplified.

A rural mail carrier in La Grange, Ga., is covering his 25 mile route by automobile.

There are 80,000,000 horses on earth, according to the computation of a Belgian statistician. Probably the figures will never be so high again unless horses are bred for the table.

The managing director of the largest motor bus company in London makes this declaration: "The motor bus is an expensive machine, but when I get one of these vehicles people forget that I dispose of twenty-four horses and the old omnibus, and the proceeds go a long way towards paying for the motor bus. I think that one of its greatest advantages lies on long services. Anything like twenty miles in a day for a pair of horses drawing a heavy bus is a tremendous strain on the animals, even with the rest which they must have on the following day."



Trailer Used in Municipal Work Abroad..

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Causes of Failures

When Economy is Not Realized Defective Structure is Not Necessarily Implied

FROM time to time one hears of a power wagon, similar in all respects to hundreds of like construction giving thorough satisfaction to their owners, which neither affords the economy represented at the time of its sale nor the prospect of a close approach to it. In all such cases it is safe to say that the fault does not lie in any defect in the vehicle.

Both the successful and unsuccessful trucks of the last five years have been of identical design. Ordinary logic, therefore would appear to force the conclusion that the cause of every failure to realize the economy of a motor wagon must be due to misapplication of the vehicle to the service in which it is employed. This is not intended to imply that power wagons have not had shortcomings, and do not still have them; but almost any wagon of orthodox construction, if properly applied, will deliver merchandise cheaper than draft animals—and that is the real test. If, in spite of this circumstance, occasional failures occur, it follows that we must look for the cause elsewhere than in any peculiarity of the vehicles themselves.

Unsystematic methods of investigation, both on the part of the buyer and seller, have been responsible for the bulk of apparent failures. Not enough pains have or are being taken to definitely ascertain the cost of draft animal merchandise transportation. Too frequently the merchant is ignorant of what his delivery really costs, while the power wagon salesman in such a situation, takes full advantage of this ignorance to draw comparisons between the service of the machine at its best and that of horses at their worst. Few make any effort to distinguish the economy to be derived from the use of one or two power wagons from that which might be expected were a more considerable number of them employed, or the stable conversion made complete. Purchase and sale are both conducted from the point of view that the whole transaction is an experiment, the outcome of which is problematical. The experience of the past is ignored.

Then, too, there is the harm of reasoning from a wagon's early performances that its splendid record will be uniformly sustained for a period of years, as if depreciation was an item that should be excluded from power wagon accounting. No little injury to the industry, and no small disappointment to purchasers, has resulted from the habit of imagining that expense of maintenance is a constant, that a brilliant beginning is a certain indication of future working expenditures.

In considering the employment of power wagons it should be a cardinal rule to ignore the draft animal service it is intended to supersede, even to the extent of abandoning stable buildings and equipment. Rent, ground value, area and convenience of stable location are matters of the utmost importance. It is not the adaptation of a single power wagon to a single route that constitutes the study, but the employment of many motor vehicles for the gross service. In short, the comparison should be made between what it actually does cost to deliver a given amount of merchandise with draft animals and what under such limitations as are unavoidable the same merchandise can be delivered for by the employment of power wagons. The advantages in favor of the latter, even on a ten years' basis, or, for that matter, any other period of time, will be found overwhelming.

In investigating the actual cost of draft animal transportation pains should be taken to ascertain that the accounts produced really represent the necessary expenses of service, and have not been padded by accident, from tradition, or for the convenience or economy of the auditor. The greatest mistake that could be made at the present juncture would be to unduly exaggerate the advantages of the power wagon in comparison with draft animals. *The power wagon needs no artificial bookkeeping to demonstrate its advantages, if honestly investigated.*

The necessity for this independent method of comparison lies in the apparently instinctive adherence to tradition and traditional methods which seems to attach itself more or less to all of us. Power wagon failures have many times been due to no other cause than the desire which the active, but frequently unthinking, man has to operate an express train on a stage coach schedule, or to maintain a whip-stock on an automobile dash.

The expense of operating power wagons, figured on the most conservative basis, will show an advantage over draft animal transportation if each is suitably applied. There is no need, therefore, for exaggerating the advantage, especially if the exaggeration is based upon the difference between the early operation of a power wagon and its operation after the ordinary deterioration of all mechanism naturally begins. By the time the latter condition arrives the user of power wagons will no longer be comparing their performance with a highly inferior performance of the draft animal, but will contrast the trifling annoyances of power wagon maintenance with the previous absence of them in the same vehicle.

A motor stage line is to be operated between Shoshoni and Lander, Wyo., for the benefit of homeseekers registering for lands in the Shoshone reservation. Each vehicle will seat 20 passengers. At first a railroad through the reservation was considered. It was impossible to secure supplies for building and this project was abandoned. The towns are 50 miles apart.

A rural mail carrier in Plainfield, Ill., is covering his 26-mile route in an automobile.

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Mail Delivery Tests

Satisfactory Six Day Demonstration of Light Machine Over Difficult Rural Mail Routes

POSTAL officials in Washington are now in possession of information which will materially aid them in deciding if the automobile is suitable for the needs of rural mail carriers, the summer tests, of which mention was made last week, having been concluded. The tests were conducted over routes in the District of Columbia, Maryland and Virginia.

The rate of travel on the first day's trial was confined to the speed of a carrier's horse—four miles an hour. The following day the machine was operated to demonstrate its superior speed, and an official of the rural mail delivery department rode in it to ascertain the fuel and oil consumption over the 23 1-2 mile route, note the behavior of the car, its suitability for postal work, and the road difficulties to be encountered, all of which observations will later form the text for an official report.

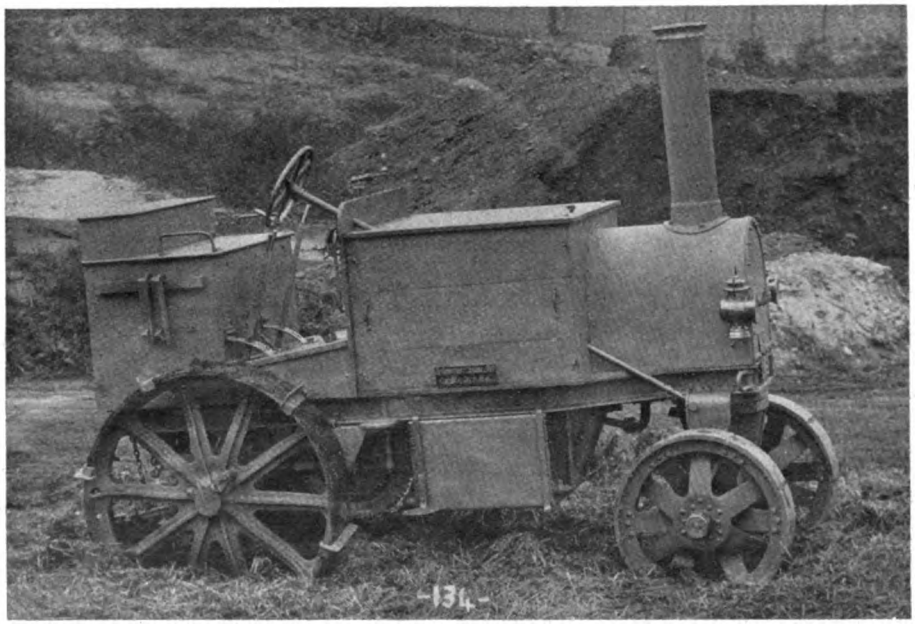
The route selected for the second day's demonstration is usually covered in six hours and forty-five minutes if a horse and cart is employed. The automobile made the trip, delivering 102 pieces of mail and collecting 35, and making 79 stops, in three hours and twenty minutes. The total weight of the automobile, carrier, passenger and mail matter was 1,000 pounds. The cost of transporting this load worked out at 8-10 of a cent per mile. The route was not particularly favorable to the machine, there being one 40 per cent grade and five varying between 25 and 35 per cent. Muddy, sandy and corduroy roads abounded. In addition, there were fields, ditches and ravines to be crossed. Still no difficulty was experienced in driving the machine over all obstacles. Its fuel consumption was 1 3-8 gallons of gasoline; lubricant consumption, 2-3 of a pint.

For the third day's test another route, 22 miles long, was selected. The horse and cart schedule for this route is also 6 hours and 45 minutes. No attempt was made to show the superior speed of the machine over it. The route has 4 miles of good pike road, 3 miles of laneways and 15 miles of road composed of sand, clay and gravel. There is one grade of 8 per cent 1,800 feet long, one of 10 per cent 500 feet long, one of 40 per cent 800 feet long, one of 5 to to 15 per cent 3,000 feet long, and other grades ranging from 5 to 25 per cent. The fuel consumption was 1 1-2 gallons; lubricant, 1-2 pint.

By the use of the automobile three hours and fifty minutes were clipped off the time usually required to cover the 25 1-2 mile route chosen for the fourth day's demonstration. On this trip 193 mail pieces were delivered, 18 were collected, and 105 stops were made. The fuel consumption was 1 1-4 gallons; lubricant, 1-2 pint.

The fifth and sixth day's tests were conducted over a route 26 miles in length. On this route there are ten miles of good pike road, and three miles of laneways. Clay roads make up the remainder. The route has three 15 per cent grades, one of 20 per cent and four of 40 per cent. A gain of three hours and eighteen minutes was made by the machine, which stopped 110 times, delivered 231 pieces of mail and collected 17. Gasoline consumption, 1 1-2 gallons; lubricant used, 1-2 pint. The fuel and lubricant calculations on this occasion were taken, not at the end of the regular journey, but upon the return of the machine to the garage and which really ended a 44 mile trip.

It is worthy of remark that during these tests no repairs or adjustments were made, either on the road or in the garage. The routes traversed by the machine are considered so bad as to make the employment of two-wheeled horse carts necessary. The gauge of the machine was 42 inches.



Six-Ton Heavy-Oil Tractor, two Cylinder 25 hp. Mot or, Under Test on Very Soft Ground. Wheels Fitted with "Spuds" to Assist the Machine in Pulling Itself Out of a Hole.

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Motor Bus Regulations

Nature of the Police Control Which is Exercised Over London Motor Bus Traffic

VERY imperfect ideas concerning the magnitude and importance of London's motor bus industry are gained by merely considering the number of vehicles which are employed or the daily cash receipts of any one operating company.

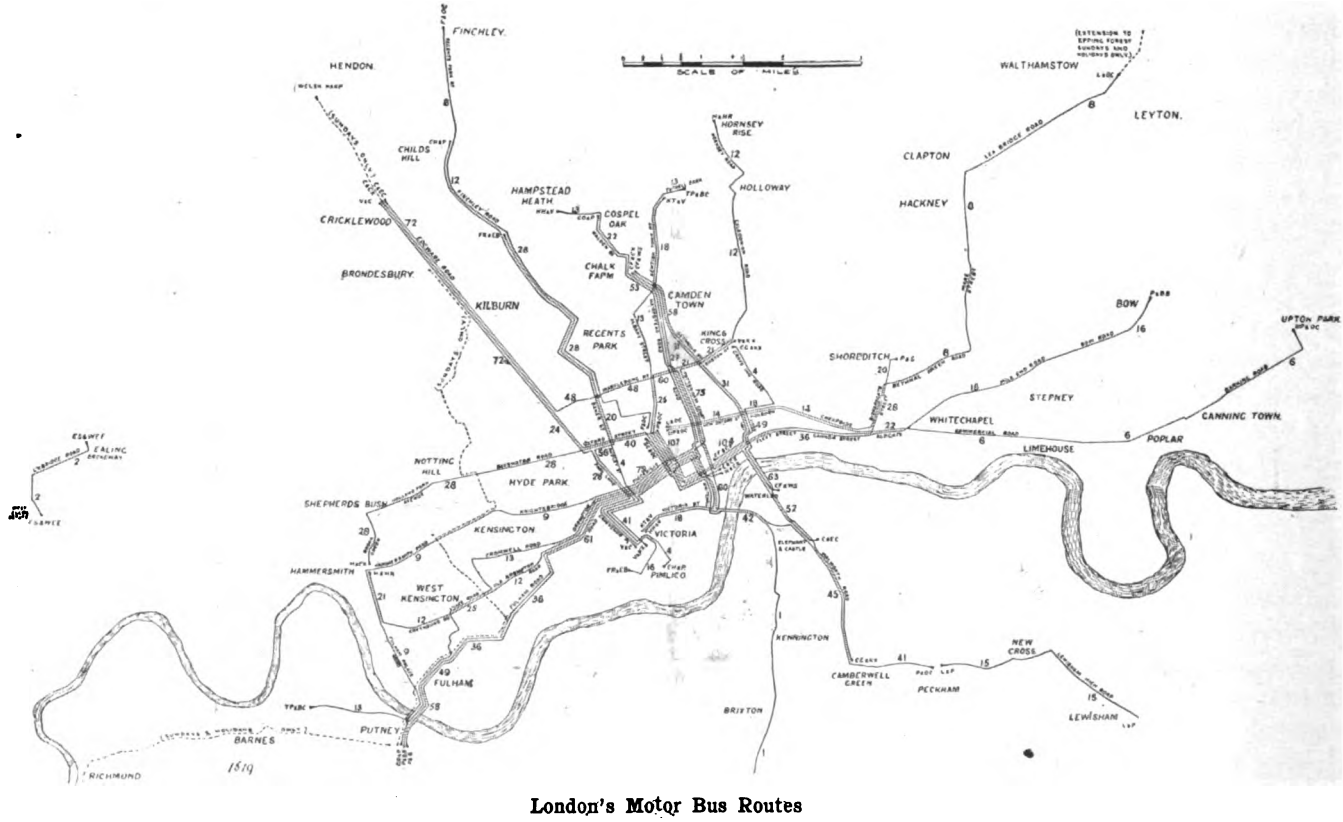
On the routes where motor bus traffic is most in evidence a vehicle covers 120 miles a day, a double shift of conductors and drivers being imperative. The service is frequent and the number of passengers carried is very large. About 1,500,000 passengers are carried each week by all the motor bus lines, great and small. This is equal to about 80,000,000 passengers for the year, which is vastly more than the street railways of any but our largest cities carry, and is sixteen times more than the population of London itself. Naturally, therefore, the regulation of such a huge volume of traffic becomes a matter of very serious concern for the authorities in control of it.

Although at present police supervision over motor buses operating in London does not extend beyond their behavior in service it has been hinted that it would be well if the police power also included the right to prescribe the structural details of the vehicles.

A witness representing the motor bus and allied industries, testifying before the investigating parliamentary commission, declared that interference of the nature suggested would seriously retard the improvement of the vehicle. At the present moment, he went on to say, it is largely a matter of opinion at to what is best in any of the many features of motor bus construction, frame, tires, motor, axles, driving gear, springs, etc. Vehicles have been placed on the road with a live axle drive by bevel gear, with a live axle drive by central chain, with a fixed axle and double chain drive, and with a fixed axle and gear drive, and no competent engineer is prepared to say, at the present time, that any one form of drive has clearly proved its superiority over the others. Similarly with motors and transmissions.

The authorities might, if given the power suggested, prescribe that an axle should not be less than three inches in diameter. In that case a manufacturer might consider that his responsibility ceased when the axle was made to the dimensions specified, and might not take due precaution with regard to material. It is, of course, quite possible to make an axle of two and a half inches diameter which would be infinitely stronger than an axle of three inches diameter, by using superior material.

The prevailing opinion at the inquiry was that the police should be empowered only to specify the trials which a public service vehicle should undergo before being licensed. It should be sufficient for a vehicle to pass such a test without considering the means by which the



London's Motor Bus Routes

TWO weeks ago there were 506 motor buses in active commission in London. Of the principal carrying companies one now employs 130 vehicles, another 82 and a third 80. The accompanying map shows the extent of territory covered, each service being indicated by a line and the numerals against the routes implying the number of motor buses moving every hour in each direction. The development of this form of traffic is one of the most remarkable features of the commercial motor vehicle movement.

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result is obtained. The test, however, should be repeated at intervals under the observation of a competent engineer.

Remonstrance was also made before the commission to the limitations put upon designing engineers in their efforts to produce public service gasoline motor cabs. It was explained that dimensions of doors and seats being similar to those of horse drawn cabs, make it impossible to construct a four-seated motor vehicle in conformity to the police regulations unless a live axle drive is employed, the regulations not permitting a door to be shaped to clear the sprocket wheel and chain casing. Having regard to the fact that such motor vehicles are in their infancy, all possible latitude should be allowed so that every improvement could be tried and the ultimate form left to natural selection or the survival of the fittest.

Further, having regard to the rapid progress of motor engineering, all regulations should remain in force for twelve months only, and should come up for systematic revision at the end of that period. As a very heavy item in the working of motor omnibuses was the cost of renewal of rubber tires, the wording of the Heavy Motor Car Act should be modified so that wooden and other tires could be tried to see if they would suit the conditions of motor omnibuses and motor cabs.

COSTLY HORSE SERVICE

THE management of one of the big hotels in Hot Springs, Ark., is about to employ motor buses for the transportation of guests to railroad depots. At present four-horse coaches are used. Sixteen animals are required to keep the service up to normal efficiency. The route is very hilly, a rise of over 1,000 feet occurring at different stages of the journey. Roads are poor in that part of the country. In rainy weather the adobe soil clings to the wheels so badly that the coach driver is often compelled to stop and clean off the sticky mud before making a fresh start.

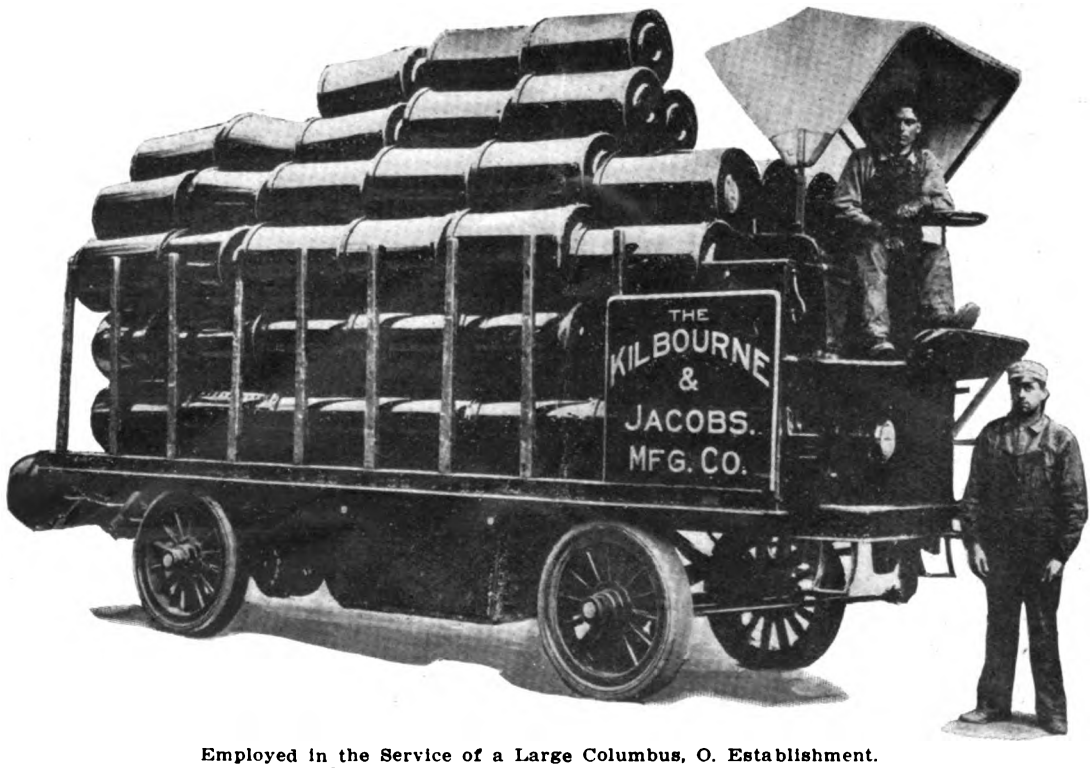
The brakes of a British motor bus, plying between London and Brighton, having failed to act, the machine ran down a steep hill, was overturned, and ten passengers were killed.

A FEEDER TO RAILROAD SERVICE

CONSIDERABLE express matter is carried between Aurora and Elgin, Ill., by the Aurora, Elgin and Chicago electric railroad. To facilitate its delivery to the interurban express car the company has recently commissioned a power wagon, which makes two trips each day to the limits of Aurora. The service was only recently commenced, but is already proving very satisfactory.

Whitestone, N. Y., and Flushing, S. I., are now connected by a motor bus line. Only one vehicle, carrying 50 passengers, is in operation at present, but more will soon be put in commission. The fare is five cents. The railroad fare is nine cents.

The purchase of motor police and fire patrol wagons is being considered by the Pittsburg authorities.



Employed in the Service of a Large Columbus, O. Establishment.

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Rail Motor Cars

Both Steam and Electric Roads Actively Engaged in Their Development

BOTH steam and interurban electric railroad companies are so thoroughly impressed with the modern developments of motor traction, arising from the general use of automobiles, that their master mechanics are being urged to investigate the advantages of other available methods of transportation than are now commonly employed.

The competition between steam and electric roads is very keen just now, not merely in the matter of passenger transportation, but because the latter threaten within the year to haul train load freight in certain districts which are now badly served by the former. The handling of light freight and packages by the interurban roads has been so successful and remunerative that the question of handling carload lots is naturally next in line of succession. Indeed it has been successfully accomplished by a few roads, but the adoption of a general plan of carload freightage over connecting lines is yet to be worked out.

Of course the steam roads are inclined to laugh at such pretensions. One of their representatives says he will give the electric lines eighteen months in which to discover that they are not only poorly equipped to handle carload freight, but that the attempt to do so will prove disastrous. By way of reply to this taunt the electric roads declare that interurban roads will be hauling train loads of coal from the coal fields in Indiana within another twelve months. Nor is this all. Ships will be met on the shores of Lake Michigan and barges on the Ohio river, and their loads transported to destination over interurban tracks.

That neither party to this struggle intends to rely upon present motive power is plain from the discussions at their councils. Both sides evince the deepest interest in the application of the gasoline engine to rail transportation. Its economy is conceded in service to which it is suited. At a recent meeting of steam road master mechanics a committee, appointed to consider the advantages of operating unit cars instead of trains and the sub itution of some other form of power than steam, reported as follows:

In response to a demand from railroad managers for a motor car to operate on branch lines and in special situations, there has been recently a development of motor cars employing gasoline in an internal combustion engine, this engine either directly driving the car or driving a dynamo to generate current to be used for driving motors in the trucks. Some builders interpose batteries between generator and motors to store the current when it is not all needed for propulsion, and to assist in starting on grades when the generator capacity may be insufficient. There is very great flexibility and convenience in this combination, but it is attained at very considerable expense and complication, and requires unusually skilled attendance, not commonly available in railroad service.

It is recognized that the so-called motor car, one carrying its own motive-power plant, whether gasoline, gasoline-electric or steam, occupies a distinct field of usefulness. On many branch lines now existing, where travel is light, and on new extensions into unsettled country where the business will not return a profit on steam train service, it would have to be run at a loss until a sufficient business was induced or built up by the travel facilities afforded. These situations are the distinct field of the motor car, which can be operated for less per car-mile than by regular steam train or electric methods until the volume of business will warrant the regular transportation method.

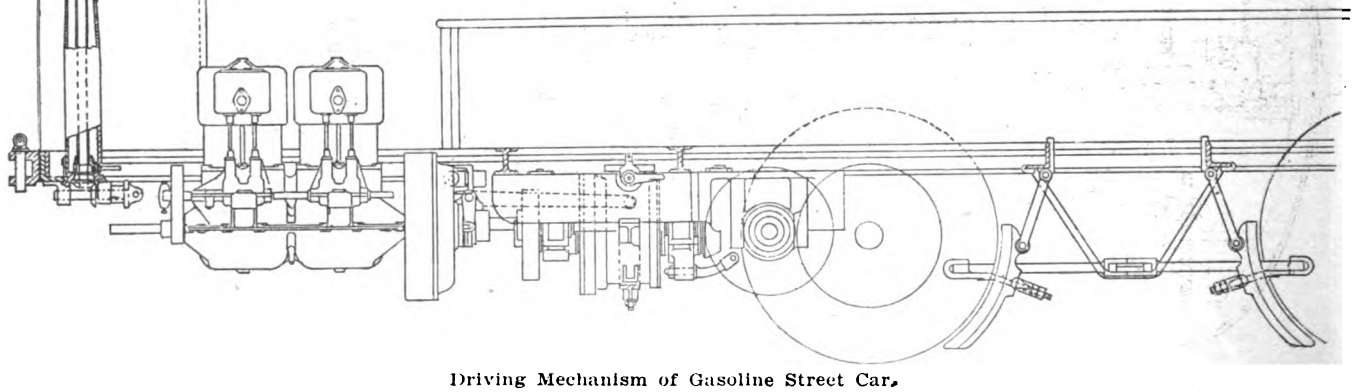
The use of motor cars on the Union Pacific is picking up passengers on branch lines, and in delivering passengers at connecting points. For through trains the service of these motor cars is exceedingly lucrative. The matter of giving the branch-line patrons of any steam road increased service, with more frequent trips per diem, is very much appreciated by the local community, and their good will is beneficial.

On the hypothesis of the same density of traffic, with the same class of service as would be encountered on one of the ordinary branch lines of the territory west of the Missouri River, the cost per mile for steam service, equipment consisting of two cars and a locomotive, would be about 24 cents.

Electric service, consisting of one car and trailer, figuring that the density of traffic is sufficiently regular to support same seven days in a week, is estimated at about 18 cents a mile.

Gasoline service (mechanical-drive only considered), consisting of one car and trailer, with baggage, mail and express service, would cost 15 cents per mile. The latter, of course, would be independent of whether service was six days or seven days per week, the cost simply depending upon the service rendered.

Managers of steam railroads, entrusted with the direction of large vested interests, are naturally very conservative about making what would appear to be radical changes in their equipment. Therefore, while they realize the limitations of the steam locomotive in suburban and



Driving Mechanism of Gasoline Street Car.

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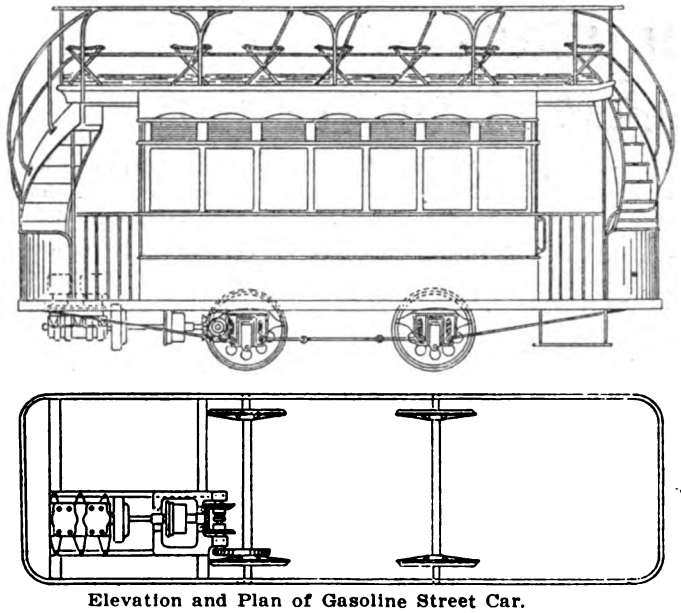


Elevation and Plan of Gasoline Street Car.

interurban service they will, before stringing the trolley wire over their tracks, try out pretty thoroughly the independent motor car, which holds out alluringly the suggestion of interurban service without power house, without the track bonding and without the external transmission circuit. This try-out will materially help in defining the true field of the self-contained car for steam railroads.

Street railway companies, urban as well as interurban, are evincing much interest in the self-contained unit rail car. A gasoline car, of which illustrations are shown, has operated for some time in a Scottish urban service. Its engine develops 24 h. p. The car, fully loaded with 50 passengers, moves at a speed of 15 miles an hour. The car is built on the double deck plan and empty weighs about five tons. It is capable of ascending a grade of 1 in 15. Power is transmitted by means of a large diameter friction clutch, thence through a special compound starting gear and suitable gearing to the axles, no chains being employed. The gear box is merely a drum held up with a pair of shoes drawn tight by a lever from the front of the car. Pulling this lever over tightens the shoes on the drum and holds it so as to allow the internal gear to work and act as a driver; pulling it further over releases the shoes and allows the gear to drive direct from the engine. This is for forward motion. To drive the car backward the driver disconnects his handle and takes it to the other end of the vehicle, and performs the same operation over again by a lever running on the then forward end of the car.

The cost of running this vehicle, including wages of motorman and conductor, is about 18 cents a mile. A day's run averages between 70 and 100 miles.

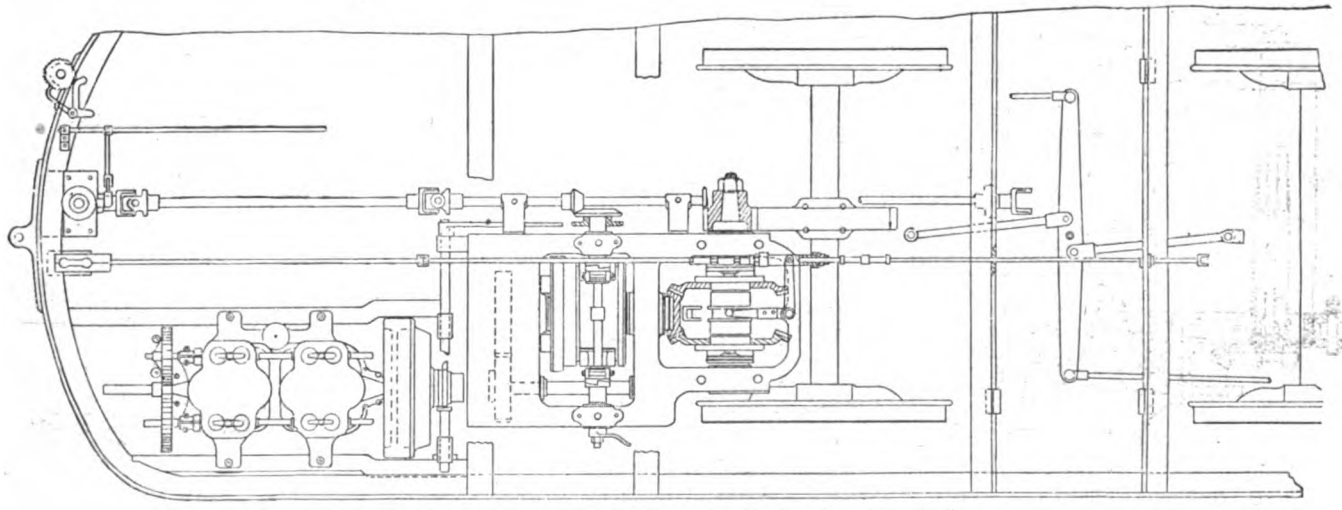
GASOLINE RAIL MOTOR CARS

THE seven gasoline cars built at the Union Pacific's shops in Omaha are employed in the following services: Cars 1 and 2 make a round trip daily on the branch between Kearney and Callaway, Neb., 65 miles. Car 3 is in regular service on the Southern Pacific between Houston and Galveston, Texas, 57 miles. Car 4, after temporary service on the Kearney branch, is now running on the Oregon Railway and Navigation line out of Portland, Ore. Car 5 is running out of Los Angeles, and car 6 is running between Leavenworth and Lawrence, Kas., making a round trip of 68 miles daily. Car 7 is now running on the Erie road.

The cost of maintaining rubber tires on London's big motor buses is steadily falling. At first it was four cents a mile. Now it is three and one-half cents. This relatively high cost is justified, however, by the fact that the average number of passengers carried by these vehicles is almost 900 per day.

During the month of June, out of a total authorized capital of $2,575,000, for public service motor vehicle transportation in London, the sum of $1,725,000 was subscribed.

The Aurora, Elgin & Chicago electric railroad has installed an automobile service in Aurora between the terminal station and the city limits. Twice each day the motor car makes the trip to the limits with express matter for the interurban express car. This service was only recently installed, but it has proved very satisfactory.



Brake and Other Mechanical Details of Gasoline Street Car.

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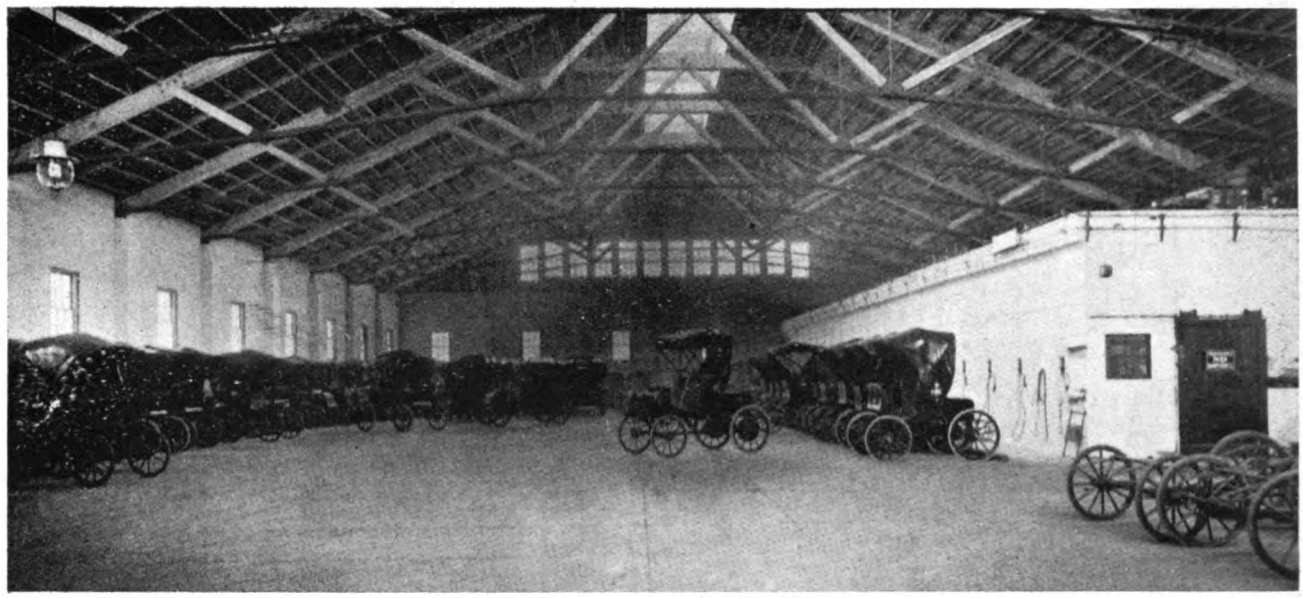

Stable Economy

Low Stable Administrative Charges Resulting From Employment of Electric Vehicles

STABLE costs are very seldom early considered by the executives of establishments which are groping their way to the employment of large numbers of power wagons. Usually, unless advised by experienced counsellors, they pause upon coming to the greater speed or load capacity of the machines, the reduced wages to be paid to drivers as a result of the lessening of their numbers, and seek to measure economy by these factors alone.

It is from such superficial study also that they endeavor to judge between the advantages of the gasoline and the electric wagon.

Administrative stable costs largely determine whether electric or gasoline wagons should be employed in an extensive service where mere working conditions might seem to indicate the balanced use of one or the other type of vehicle.

If the electric wagon had only its inferior mileage to recommend it to purchasers, it is certain that it could not, in the face of the stiff competition offered by makers of gasoline machines, hope to justify its supremacy both in numbers and the variety of service in which it is employed. What, then, are the special attributes which give it rank and entitle it to consideration? The most important is the low cost of caring for a quantity of them, which, done into different language, spells low administrative stable costs.

Enthusiastic admirers of the electric wagon are fond of remarking that a competent caretaker can superintend the charging and repair of one hundred storage batters as easily as he can give attention to ten. Instances where the accuracy of this statement might be tested are rare in power wagon practice. They exist however.

Take the Babcock Electric Carriage Company's garage, in Buffalo, as an example of what stable administrative economy is afforded by the employment of electric vhicles. While the 100 machines which are at this moment stored on the floors of this establishment are, it is true, exclusively employed for pleasure, it is none the less the fact that the care which they require is fully up to that which would be needed for one hundred light commercial electric vehicles.

One man, drawing wages at the rate of $15 per week, wholly superintends the mehanical upkeep of these machines, repairs and adjustments being rather inconsiderable in vehicles of this class. The foreman of the battery room is on the pay roll at $20 per week. He is supplied with two assistants, one of whom looks after the batteries in the cars, while the other attends to the charging and performs other duties not strictly related to the maintenance of the batteries in the cars. These two battery room assistants are also occupied in assembling new batteries. In reality, therefore, only the wages of the foreman and one of his assistants, each of whom is paid $12 per week, should be charged as expense against the battery room. In addition to the services of the help above enumerated, three vehicle washers are employed, the total of whose wages amounts to $35 per week.

Thus the total of wages for the care of one hundred electric machines is found to be $94 per week. All of the vehicles in the establishment under consideration are as actively employed as would be the case if they were in regular comercial service.

It would be invidious to compare the low stable administration costs of this establishment with those which attend an establishment of equal size having nothing but gasoline vehicles on its floors. It is enough to say that in all probability one high priced expert would be required to care for every ten vehicles, and that this ratio might be decreased as the vehicles aged and developed the infirmities to which mechanism of all kinds is subject as it ages.

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Their Attention

IT is not easy to account for all coil troubles, as close inspection does not always immediately disclose the cause of interrupted action. Temporary interruption of the circuit at the platinum points, however, causes most of them. The most minute speck of foreign matter will, of course, interrupt a low tension circuit, and no current can pass. A particle of dust or grit will do it, and obviously this points to the necessity of having a well fitting dust-tight cover to the coil case. If the contacts are of perfectly pure platinum they should not blacken or foul, but should a deposit form through faulty contacts it is likely to cause trouble. There is only a very light pressure between the contact points or surface; and any fouling is fatal to working. There is also the possibility of having the adjustment of the contact screw too lightly set; then, after a time, when the platinum becomes worn, a very uncertain contact occurs. It will usually be found that in a case of this kind the beat of the engine will gradually become more feeble.

Loose and Leaky Spark Plugs

Spark plugs with loose and leaky centers are by no means uncommon, but few try to discern and remedy the cause of the trouble. More often than not the source of breakage can be traced to the insulated wire pendant from the plug terminals, or to the wires from the overhead stay to the plugs, which transmit vibration which results in a breakage. There is one method by which this transmitted vibration can be entirely obviated, and the life of the plug increased considerably. It is to solder a fine coil of iron or other wire to the end of the high-tension cable, support the cable firmly, and connect the remaining end of the coil to the plug terminal. In this manner the weight of the cable is taken from the plug and the fine coil is quite incapable of transmitting the vibration.

A Study of Compression

When a loss of engine power is noticed the blame is often ascribed to bad compression. Compression arises from drawing into the cylinder a charge of gaseous mixture by one stroke of the piston in its downward direction and then with the upward stroke compressing the gas into a space approximately one-fourth of the cylinder's cubic capacity, ready for ignition and expulsion during the two succeeding strokes of the piston. Compression of the gas naturally gives it greater expansive or explosive properties when ignited by the electric spark. In this way the power of the stroke of the engine is produced. It follows, therefore, that the power developed by the engine depends very largely upon the extent to which the gases taken into the cylinder are compressed, though this is also a question of the number of revolutions which the crankshaft makes per minute. The limits to which compression can be carried are restricted, as the compression of the charge places negative work upon the engine by absorbing some of the power developed, and thus reducing the effective power of the engine in a certain proportion to the increase in the rate of compression. From this it will be seen that there is a point where power and compression balance each other, and that is the point at which a motor works most efficiently. Any increase of power which is obtained by increase of compression is counter-balanced by drawing on the increase power to overcome the increased compression.

Necessity for Grinding In Valves

The importance of keeping the valves of an engine properly ground in is not sufficiently appreciated. Many wagons are pulling badly today owing to neglect of this adjustment. To maintain full power in the engine the valves must be in perfect condition, and kept so. Some are just as keen to continually grind in their valves as others are to neglect them. It is a process which can be overdone. Unless a valve is badly burnt such a drastic cutting medium as coarse emery is unnecessary. The best plan in a bad case is to have the valve faced up in a lathe, care being taken to keep the correct angle of the seat. A burnt valve is easily recognized as quite a scale forms, which can be chipped off in flakes. Valves are burnt by using too rich a mixture, keeping the car on a low gear, and overheating of the cooling water. When a valve has to be re-turned the stem will generally need shortening to an amount equal to what is taken off the head. When a valve is being ground in, the part leading into the cylinder should be stopped up with rag to prevent any particles of emery getting into the cylinder and cutting the walls. Care should be taken also when the job is finished to thoroughly clean out the valve pockets and seatings. Just a few particles of emery lodging on the valve seat would prevent its closing completely and loss of compression would result, while emery in the cylinder would score the walls. The best medium for grinding in valves is a paste made up of flour, emery and grease, and about the constituency of ointment. Valves should be ground in as often as the circumstances demand—it is difficult to fix a period, but examinations of the seatings will show if grinding is necessary. A properly seated valve should show a bright ring of metal all around the seat. If valves and seatings are allowed to become pitted they require a good deal of grinding in. If kept in good order no pitting is allowed to form.

The village authorities of Oak Park, outside Chicago, are considering the purchase of a motor police wagon and fire vehicle.

The common council of Trenton, N. J., has decided to install a self-propelled combination hose wagon, chemical engine and ladder truck.

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CLEVELAND, OHIO

AGENT APPOINTED.—Fred H. Adams, 541 Tremont St., Boston, Mass., has been made agent for the Atlas gasoline truck and commercial cars manufactured by the Motor Truck Company, Springfield, Mass.

SUPERINTENDENT OF CONSTRUCTION.—F. C. Lindoerfer, who was formerly assistant to F. W. Roberts, the well known gas engine expert of Clyde, O., is now superintendent of construction at the factory of the Logan Construction Co., Chillicothe, O.

CATERER'S WAGON.—W. S. Balduff, caterer and manufacturer of confectionery and ice cream in Omaha, has ordered a one-ton gasoline truck from the Rapid Motor Vehicle Co., of Pontiac, Mich.

TRUCK FOR MARKET GARDENER.—John Heimer, a market gardener living twenty miles from Danville, Ill., is hauling his vegetables and fruits to market in an 18 hp. gasoline wagon made by the Olds Motor Works., Lansing, Mich.

A REPEAT ORDER. — Dinet, Nachbour & Co., of Joliet, Ill., having satisfactorily used a Cadillac gasoline delivery wagon for the past two years, recently ordered another, fitted with 10 hp. engine.

THE COMMERCIAL TRUCK
cannot afford to have anything but the BEST. The ignition is undoubtedly the heart of the power wagon.

THE SPLITDORF COIL
is universally acknowledged the BEST. You cannot afford experiments.

(Made in America since 1858 in the Splitdorf Laboratory).

C. F. SPLITDORF
17-27 Vandewater St. New York N. Y.

Columbia Electric 1,000 Pound Delivery Wagon Used by The Lincoln Trust Co., of New York.

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ADVERTISING RATES ON APPLICATION

WALTER WARDROP, EDITOR AND PUBLISHER

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Power Wagon Ratings

Conflict Between True and False Standards of Rating Causes Confusion and Trouble

THE rating of a power wagon is a matter which does not receive half the attention it deserves either at the hands of the manufacturers or users. The former are inclined to belittle its importance until bitter experience shows them the folly of such behavior, while the latter, accustomed to the illogical standards of rating set by teamsters, express companies and others, are with difficulty persuaded that a motor wagon cannot with safety and economy haul greater loads than it was designed to transport.

Disaster is sure to attend every attempt to operate a wagon designed only for a maximum load of, say, 1500 pounds in a service calling for constant and heavy overloads. It will not do to justify such a course by saying: "This was a 1500 pound wagon; if the customer loads more than 1500 pounds and anything happens, it is his fault." The power wagon has had already too many set backs from this cause. Those marketing power wagons to-day, and offering them at a given rating, must assume that they will be used in the same general manner as wagons of the same rating operated by draft animals.

Some idea of the abuse to which power wagons are subjected may be obtained from a record of one year's weighing in of every trip of an express wagon *rated* at 1500 lbs. The service is such as is ordinarily assigned to a wagon of this kind and rating. It made one trip with 7,000 pounds on board. It made three trips with about 4,000 pounds on board. It made very many trips with about 2,800 pounds on board. The average weight was under 1,000 pounds. These were all stable weights; that is to say, they were the weights with which the wagon started out full loaded and which were being continually decreased as the wagon delivered the goods and came back nearly empty, making a still lower average for the round trip. This is fairly representative of 1,500 pound service, and on the face of it, from an engineering point of view, is not economical.

The extent to which economy on this point can be introduced without undue sacrifice of convenience, complication of service, or expense of investment, remains to be determined, and will differ with every case; but in the meantime, the manufacturer of power wagons has enough to do in convincing the teamster of the superior economy of the power wagon without attempting arbitrarily to re-establish standards which are as well recognized and firmly established as those under which horse-drawn wagons are generally bought.

It is possible that when the use of power wagons becomes general the actual measure of service which their power plants afford will enable us to provide more definite ratings than exist today, so that any given service having been stated, a vehicle can be selected to perform it under conditions in which the fluctuation between the average and maximum load will be so small as to make the statement of the wagon rating an exact indication of just what loads will have to be carried. At present, however, this is very far from being possible, and those who sell power wagons in disregard of the true significance of horse wagon ratings as now employed in most cases find themselves supplying vehicles really inadequate for the service, if rated loads are to be taken as maxima; and far in excess of and therefore too expensive for the service required, if rated loads are to be taken as average.

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Electric Wagon Maintenance

Figures Which Are Fairly Representative of the Cost of Operating a 2500 Pound Vehicle

THE cost of maintaining any power wagon, gasoline or electric, must of necessity vary as the skill of the operator or stable attendant happens to be great or small. The best vehicle, therefore, is in the long run the one which is given the most scrupulous attention both in and out of the garage, assuming, of course, that it is suitably adapted for the work to which it is assigned.

It is of the utmost importance to bear this in mind when attempting to anticipate the maintenance charges on motor wagons of either type in advance of their actual employment.

In electric wagon accounting it is proper to regard the battery as "slow fuel." By the majority, however, it is wrongfully looked upon as "permanent investment." The most severe service of which there is any record required renewal of positive plates in nine months and of negative plates about once in twenty-four months, with more frequent renewals of separators in the meantime. This alone should immediately suggest that the outlay for all but the jars of the battery is expense in the strict sense of the term. The reservation of the jars from such an account would, strictly speaking, follow this line of reasoning, but it would be a needless complication to carry the cost of jars to investment except in very large installations. The renewals mentioned represent experience with a battery on a fairly well designed vehicle, handled with very little attention, but that of an intelligent kind, at a time when batteries really were not as fool-proof as they are today

Selecting a wagon with a rated load capacity of 2,500 pounds, and costing, say, $2,500, let us see what it can be maintained for. The accumulated experience of the past four or five years justifies us in believing that the figures will not vary much from those which follow, although instances are not wanting to show that they have been bettered.

Investment

Probable price of wagon	$2,500.00
Extra ¼ battery	136.28
Total	$2,636.28

The extra ¼ battery is only necessary when severe service is required.

Expense

Interest at 6% and depreciation	$ 315.58
Rubber tire repair and renewal	190.00
Mechanical and electrical repairs	108.00
Charging current 350 times at 94c	329.28
Battery renewals and cleanings	311.80
Total per annum	$1,254.66

If electrical current is made with 27 cent gas this item of expense would be reduced to $73.28 and the total expense would be $998.66.

In fairly easy service, under the best conditions and with experienced care, these figures can easily be reduced to about $720.

Such a machine should effect a saving of from 20 to 25 per cent over draft animal service, doing the work of at least two horse drawn wagons of the same rated load capacity and under some circumstances three. The figures assume that the vehicle is adequately powered; that the attendance it receives is such as may ordinarily be procured; that extra trays of battery are employed to avoid interruption of service for cleaning; that batteries are given ordinarily good care and promptly renewed when renewal is necessary; that suitable precautions are taken against overcharging; and that current is purchased at 4 cents per kilowatt hour.

It is implied, of course, under the provision made for renewals that when the wagon structure is eventually worn out the power plant and much else is available for use in a new machine.

Unclassified repair expense on such a wagon, which is included in the foregoing estimate, should not average more than $5 a month during its first years of service. The nature of such expense is well indicated in the following tables which, though covering but a period of four months, are representative of the annual outlay in an active service:

Repair Expense for March

Pulling wagon out of mud	$ .25
Axle grease	.25
Replacing lost nuts on front spring shackles	.20
Soda and distilled water	.35
Fitting wooden brake shoe in place of old shoe	.35
½ lb. brads for brake shoe	.08
Emery paper	.05
Four iron washers	.10
	$1.63

Repair Expense for April

Axle grease	$ .50
New wrench for axle nuts	1.00
Two drills	.20
Putting in new brake clip	2.00
Repairing bent chain and distance rod	.60
Copper rivets	.08
Repairing broken brake clips and tightening steering gear	3.75
Welding broken battery hanger iron	1.25
Gasoline for cleaning motor commutator	.05
	$9.43

Repair Expense for May

Axle grease	$ .50
One file	.40
Bolts	.10
Rivets for brake shoe leathers	.10
Repairing broken battery hanger	1.25
	$2.35

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Repair Expense for June

New clip and nuts for spring	$ .35
Axle grease	.50
Straightening bent rear axle	2.25
Repairing tail gate irons	.50
Riveting wheel felloes	.75
Repairing broken brake irons	.50
Pan for washing chain	.25
½ gallon gasoline	.10
Repairing broken top irons	.30
	$5.50

MOTOR BUS CENSUS

ON July 9, when the motor buses in London were last counted, it was found that 543 vehicles were in commission, an increase of 37 over the previous fortnightly census. The greatest number of machines owned by any one operating company is now 144, the next two ranking companies having, respectively, 84 and 85 vehicles.

MOTOR MAIL COLLECTION

APPLICATION has been made by Postmaster Davis of Pittsburg, for governmental permission to collect mail by motor wagons in the down town district.

At present there are eight foot collectors and seven cart collectors in the district, besides the 74 carriers who make scheduled collections. With this force the mail can not be got in rapidly enough and the collectors cannot keep up with the increased amount of mail handled. It is proposed to have an automobile truck placed in service with a 10-foot body and width of 50 inches above the wheels. This truck, according to the plans submitted, will make scheduled collections and will take the mail from the cart and foot collectors at stated points and times, thus relieving them of the necessity of going to and from the postoffice. At present about 50 per cent of the collectors' time is given up to getting the mail to the office. The automobile will return to the office when full, or in time to dispatch mail to the stations, or to the depots for the railway mail service. The collectors will have their mail all ready for the automobile when it comes around and will exchange the full sacks for the empty ones, and will not need to leave their routes.

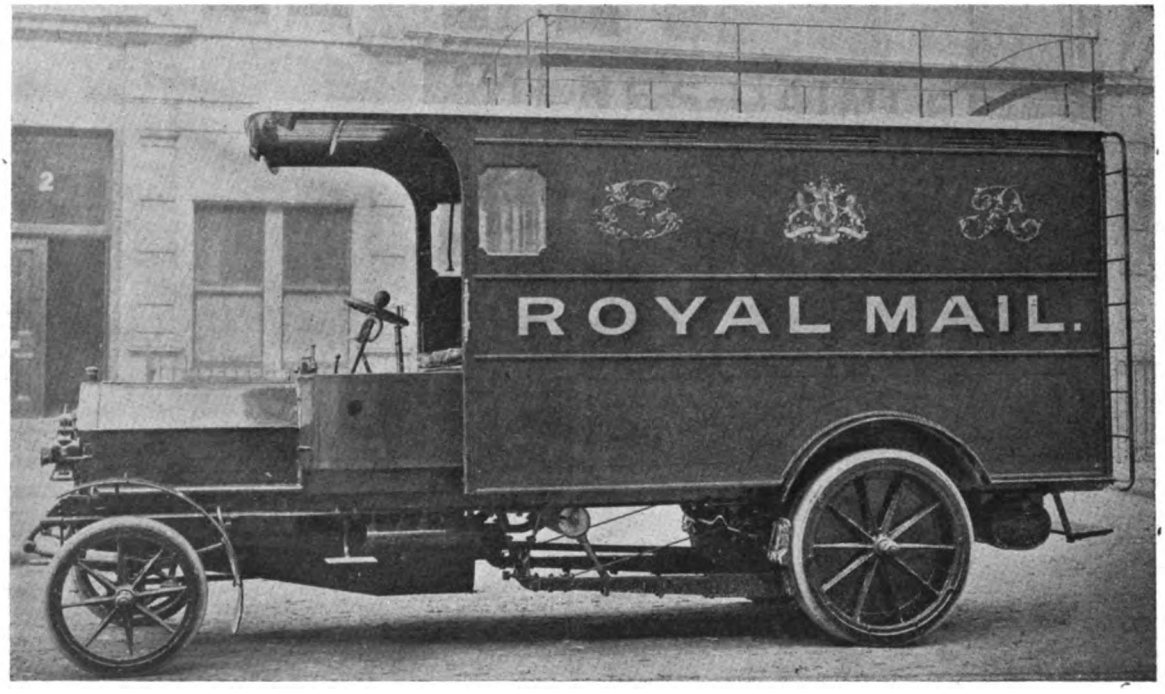
MOTOR MAIL DELIVERY

TWO rural mail carriers with headquarters in North Baltimore, O., are using machines to cover their territory. One uses an automobile and the other a motor cycle. The automobile makes a daily trip of 30 miles, averaging 150 stops, in four hours. In the past nine months it has been out of commission six weeks on account of bad roads. Both carriers say the machines are cheaper to maintain than horses.

GASOLINE MOTOR RAIL CARS

FOR some time past the executive officials of the Buffalo, Rochester & Pittsburg Railway have been considering the operation of independent rail motor cars on such parts of the system as appear to need a better service than is afforded by the regular trains. As a result of these deliberations it is semi-officially announced that the inadequate train service between Rochester and Le Roy will be supplemented by the installation of gasoline rail cars. Le Roy is the most important station on the B., R. & P. between Rochester and Salamanca. It sends out more freight than any station between Rochester and Pittsburg, and its people feel that they are entitled to better train service.

The Argentine post office has been authorized to purchase six motor vehicles for the conveyance of mail bags. The order for these vehicles will be placed in Paris.



Thirty hp. Two-Ton Gasoline Mail Van—One of Three Just Put in Service Between London and Hastings.

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An Instructive Paper

A Municipal Engineer Describes the Economy and Advantages of Motor Wagons He Employs

(By John A. Brodie, City Engineer of Liverpool)

VERY few people are qualified to instruct power wagon users concerning the economy of the vehicles. In many candidates for the honor the experience necessary to institute accurate comparisons between the cost of draft animal service and that of motor vehicles is either conspicuously lacking or else it is tortured to make a too favorable case for the machines. Occasionally, however, one well equipped for the task is dragged out of retirement and induced to tell what he knows on the subject. If his utterances coincide with prevailing opinion, they are, as a matter of course, approved; if in disagreement, at least his purpose is not challenged.

Making suitable allowance for evident unfamiliarity with the wide use of electric wagons in this country, perhaps Mr. John A. Brodie, the municipal engineer for the city of Liverpool, is as competent as anybody to speak on the subject of the general economy of power wagons. His experience with the machines began at a time when few had the hardihood to consider their use and fewer still the temerity to construct them. Naturally, his education began with the steam wagon, but as he is a progressive and observing official he has not permitted this early experience to mold his present thought. Mr. Brodie is something more than a user of power wagons. He continually labors for their improvement, taking a keen interest in the progress of construction, suggesting remedies for defects and at all times evincing a student's intelligence in the economic problems involved by the employment of the machines.

His paper on the subject of "Motor Vehicles for Municipal Work," read at the annual meeting of the Association of Municipal and County Engineers recently held in London, of which the first installment is herewith presented, is of much wider interest than the title might seem to indicate. It deals with many matters which are subjects of everyday deliberation in commercial life, completely establishing the economy of a type of machine which is generally recognized as far inferior to the modern vehicles which are made in its likeness. More than all, however, the proofs of this economy are incontestible, appearing not as conjecture, but as well reasoned conclusions from facts and figures submitted.

Such documents are rare as they are precious. And so we have no hesitation in making the most of this one, though our foreign correspondent has in previous isues anticipated some of the statistical information presented. Mr. Brodie's paper follows:

The use of light motor vehicles for industrial and other purposes first became practically possible in England after the passing of the Motor Car Act of 1896. About that time several societies and associations were formed for the purpose of gathering together persons interested in the advancement and improvement of motor traction on ordinary roads. In 1896 a branch of the Self-Propelled Traffic Association was formed in Liverpool, having on its Council a number of influential representatives of the shipping interests and trade of the port of Liverpool, and of the engineering profession, who expended a large sum and gave much valuable time for the purpose of encouraging the construction of motor vehicles for commercial purposes. Exhaustive trials held in 1898 and following years in Liverpool, together with the very full reports and particulars of the performances of the vehicles, probably did more than anything else in the early days of the movement to make known the possibility of the heavy motor vehicle.

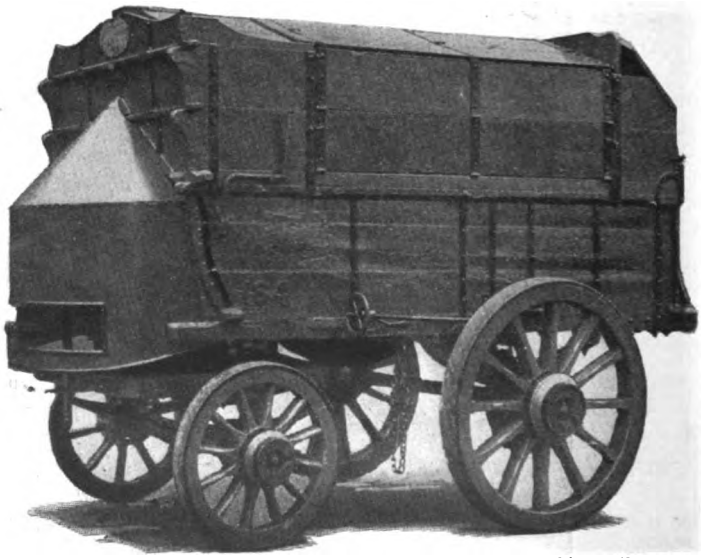
It was soon seen that a considerable opening for such vehicles would be found in the work carried out by municipal authorities, and during the trials in May, 1898, the then lord mayor of Liverpool publicly stated that he was so much impressed with the working of the motor wagons that he would do what he could to see whether the machines could not be used in the Corporation service, to greater advantage than horse-and-cart-traction.

At the conclusion of the first trials an order was placed for a 4-ton steam vehicle for the use of the Liverpool Corporation. This machine, which was delivered in January, 1899, is still at work, though it was soon found advisable to reduce the load carried and use the vehicle for lighter work than was originally intended. It has, however, been found a most valuable help in quickly conveying materials from depots to street works in progress and for street gravelling, and during the summer season it has been also largely used for street watering and other purposes in which the weight of the load to be carried is not a matter of first importance.

The experience gained by the regular working of the earlier types of vehicle was of considerable value to users and manufacturers. It was soon found that oil firing would have to give place to coal or coke-fired boilers, while, contrary to the general practice in the lighter type of vehicle, the vertical type of engine originally adopted has also given way to the horizontal type, no doubt principally on account of the demand for platform space.

After the completion of the third Liverpool trials in 1900, the city ordered six 4-ton steam motor wagons, which were obtained in the beginning of 1901, and these have been continually in use up to the present time.

At first, owing to the training of drivers and the elimination of unsatisfactory men, the proportion of time lost from actual work was excessive, but this was reduced as the men gained experience.



Trailer Used by Liverpool Municipality. Drawbar Pull Comes Upon Body of Trailer, Bar of Front Wheel Carriage Being Used Only for Steering.

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These wagons have been well maintained and are now in good working order, all unsuitable portions having been replaced. Repairs at the present time are costing less than formerly, while the average time lost is also less than at any period of their life.

The principal troubles which have been experienced in connection with the use of these vehicles have arisen from the fact that they were originally constructed to comply with the then existing law that the tare weight should not exceed 3 tons, which it was thought advisable to make one of the conditions of the specification. It was, however, soon found impracticable to adhere to the tare limit, if the vehicles were to carry paying loads. Very considerable alterations have had to be made to them, and the weights of such parts as frames, springs, axles, and wheels have been materially added to—the total weight with steam up and ready for work now amounting to 4 tons 19 cwt. on the average, as against their original nominal tare of 2 tons 19 cwt. 3 qr.

The passing of the Motor Car Act of 1903, combined with the regulations which were subsequently issued, was welcomed by motor users throughout the country generally, as it legalised the additions which had already been made a matter of necessity. The alteration in the weight limit, together with the additional requirements as to the width of tire, appear to have met the demands of motor users. Since the necessary alterations to comply with the provisions of the Act have been completed, the difficulty at first experienced in maintaining the motor wagon wheels has entirely disappeared. The only difficulty which still remains is the noise and vibration caused by the running of the wheels over the comparatively rough roadways; and this is likely to remain so long as a rigid wheel is driven at a considerable speed over the rigid and uneven roadways which still exist to a considerable extent in the older neighborhoods of Liverpool.

In Liverpool a considerable number of wheels have been experimented with. In the first instance the manufacturers of a solid rubber tire came forward and offered a contract with the payment arranged on the basis of mileage run, the existing wheels being provided by the company with special rims suitable for their own type of solid rubber tires. The front wheels of the wagon, which at that time carried an axle load of 2½ tons, ran some 1,500 miles before failing and satisfactorily reduced noise and vibration so long as they lasted. The driving wheels, which carried an axle load of 6½ tons, only lasted 300 miles; and up to the present time, though every effort has been made to obtain a guarantee of solid rubber tires, no manufacturer has been found ready to contract with the Corporation for rubber tires for these vehicles, although for some purposes the Corporation was prepared to pay a rate per mile in excess of that now annually paid for the maintenance of motor omnibus tires.

A trial was also given to an early type of resilient wheel manufactured under the Gare patents, the tire consisting of hardwood blocks, jointed on rubber with treads consisting partly of fibrous material, the whole being completely impregnated with rubber solution. So far these wheels have not completed their mileage under the contract. This type of wheel has, undoubtedly, advantages, especially in the matter of freedom from side-slip on stone sett pavement, and also to a great extent from noise, but there appears to be some difficulty in making it sufficiently lasting in the case of the driving wheels, where the axle load amounts to 8 tons.

A metallic wheel under the Hele-Shaw patents has also been experimented with, and this type of wheel has completed a distance of about 3,000 miles. In this wheel the spokes are made of steel, and provision is made for play at the hub something after the style of a toggle joint. The noise and vibration have been considerably reduced, but up to the present time the spokes have been rather light for the strains thrown upon them in Liverpool, due to the axle weight and the rough condition of the boulder-paved streets passed over.

An offer was also accepted for the trial of a pair of wheels with a rubber tire shielded by metallic sectional plates, called the "Buckingham" tire, but this wheel did not give satisfactory results, as a number of the shields gave way, and these had the effect of injuring the resilient tire underneath.

Another pair of wheels has been tried to some extent, the tread portion consisting of paper impregnated with a composition and afterward compressed between plates. This arrangement has undoubtedly resulted in a quiet wheel, but the trial has not been sufficiently extended to state definitely whether a satisfactory life can be got out of it.

Some two years ago the idea occurred to the author that it might be worth while to try the wear of double pneumatic tires with an outside stiffened rim, so that the vibration due to the hammering of the tire on the setts need not be transferred to the machinery. A pair of wheels on this principle were constructed, and have been continuously in use since January, 1905, traveling over 5,000 miles, and have required practically no attention beyond the fixing of stops between the outer and inner rims, so that slip and consequent wear between the stiffened rim and the rubber tires could be avoided.

A peculiarity which has been observed is that the wear on the steel tire is not noticeably less than in the case of tires shrunk on to wooden wheels direct. The cost of maintaining the machinery is less, due apparently to the reduction of vibration.

Several types of rigid wooden and metallic wheels are now in use which have not cost anything for repairs since they were altered to comply with the new requirements as to width, and no cases of injury to road surfaces by motor wagon wheels have since been recorded in Liverpool.

The Liverpool vehicles were originally fitted with cast-steel cranked axles and axle-arms. This material, however, does not appear to be suitable for the severe shocks and strains thrown upon it in practice, and it has been found necessary to replace these axles by straight axles of wrought steel of good quality, with the spring seating shrunk on, and the axle arms, in the case of the front wheels, being also made of forged steel. These axles have now been in use for a period of approximately two years without failure.

The steel springs originally supplied with the vehicles gave trouble from time to time, and it became necessary to strengthen them by fitting additional leaves. In the case of new springs it has also been thought advisable to reduce the camber. Considerable advantage has also been found from the fixing of grease-cups on the shackle ends and moving parts of springs; and this

Type of Wheel Satisfactorily Experimented With on Liverpool Motor Dust-Wagons..

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also applies to all moving portions, as provision for continuous lubrication of all moving parts of motor vehicles is useful in preventing loss of time when on the road.

Though the drivers of steam vehicles use the engine to a great extent for the purpose of braking, both the brakes required by law should be kept in good condition. Experience shows that the best results are obtained from brakes on which the surface are metal to metal, the brake straps lined with wood originally supplied with the vehicles having been discarded.

The engines and gears have continued to give good service without requiring very much in the way of repairs.

The boilers of the whole of the vehicles in use by the Corporation of Liverpool are of the vertical fire-tube type, which have given an average life of four years before requiring important repairs, except in the case of two furnace crowns, which were damaged through shortness of water. The whole of the tubes have been removed and renewed during the past twelve months at a cost of about $62.40 per boiler, and the boilers are now quite equal to new throughout.

It is very important that all workmanship and materials in connection with boilers for motor work should be first-class, and that the design should be as free as possible from small parts and corners which cannot be cleansed and washed out, which work should be done at short intervals, and as thoroughly as possible. This work, as well as everything in the nature of repairs to such vehicles, should be under the control of men practically acquainted with engine and boiler work, and, even where such men are available, it is well to have an independent inspection of the boiler during construction, and subsequent annual inspection and guarantee by one of the first-class associations which undertake this kind of work.

Where, as in the case of Liverpool, a sufficient number of vehicles are employed, it has been found a considerable advantage to keep repaired and ready for use interchangeable spare parts such as:—

1. A boiler complete.
2. A back axle with wheels and springs complete.
3. A front axle with wheels and springs complete; as well as chains and other parts which require renewals from time to time.

Much loss of running time may be avoided by the quick removal of injured parts for repairs and their replacement by the parts kept ready for immediate use.

The vehicles were at first put on ordinary day work, but as they did not compare so favorably with horse haulage as was expected, they were for about a period of eighteen months put on double shifts. This had the effect of reducing the cost to a point below horse haulage. As the vehicles in question were principally used for collecting refuse and conveying it to the destructor stations, the working of double shifts was found a great convenience, the material coming in at approximately a constant rate throughout the working hours of the destructors, which were already on double shifts, viz., from 5 o'clock a. m. to 12 o'clock (midnight), or a total of 19 hours per day. This method of working was found specially suitable for the distribution of refuse to the destructors, which were used for steamraising purposes.

The most serious hindrance to this method of working arose from the complaints received from persons who were disturbed either in the early morning or late at night by the noise and vibration of the vehicles passing their houses. The objections on this ground became so numerous and continuous that it was ultimately decided to restrict the use of the vehicles to the hours between 7 o'clock a. m. and 7 o'clock p. m., and to reduce their speed when loaded.

Comparative Statement as to Operations of Motor Wagons and Horse-drawn Vehicles in City of Liverpool on exactly similar Classes of Work. Distance travelled, 2¼ miles each way.

		Motor Wagons		Horse-drawn Vehicles		Weight of Load Carried					
		Times kept	Time occupied.	Times kept	Time occupied	Motor	Trailer		Horse vehicle		
						tons	tons	cwt.	tons	cwt.	qr.
1st load	Left P—Depot (or stable)	7. 0 a.m.	Journey .... 27 min.	6. 0 a.m	Journey .... 50 min.						
	Arrived T—Road, 2¼ miles	7.27 "		6.50 "							
	Left T—Road	8.47 "	Loading.... 80 "	8.10 "	Loading.... 80 "	5	3	0	1	10	0
	Arrived C—Street Depot.	9.17 "	Journey .... 30 "	9. 8 "	Journey .... 58 "						
	Left C—Street Depot...	9.35 "	Tipping.... 18 "	9.23 "	Tipping.... 15 "						
2nd load	Horse baiting			10. 3 "	..... 40 "						
	Arrived T—Road	10. 2 "	Journey .... 27 "	10.53 "	Journey.... 50 "						
	Left T—Road	11.22 "	Loading.... 80 "	12.13 p.m.	Loading ... 80 "	5	2	14	2	2	2
	Arrived C—Street Depot.	11.52 "	Journey .... 30 "	1.11 "	Journey .... 58 "						
	Left C—Street Depot...	12.10 p.m	Tipping.... 18 "	1.26 "	Tipping.... 15 "						
3rd load	Horse baiting			2.26 "	..... 60 "						
	Arrived T—Road	12.37 "	Journey .... 27 "	3.16 "	Journey .... 50 "						
	Left T—Road	1.57 "	Loading.... 80 "	4.36 "	Loading ... 80 "	5	2	9	1	9	2
	Arrived C—Street Depot.	2.27 "	Journey.... 30 "	5.34 "	Journey .... 58 "						
	Left C—Street Depot....	2.45 "	Tipping.... 18 "	5.49 "	Tipping.... 15 "						
	Arrived at Depot			5.59 "	Journey .... 10 "						
4th load	Arrived T—Road	3.12 "	Journey .... 27 "								
	Left T—Road	4.32 "	Loading.... 80 "								
	Arrived C—Street Depot	5. 2 "	Journey .... 30 "			4	2	3			
	Left C—Street Depot....	5.20 "	Tipping.... 18 "								
	Arrived at P—Depot.....	5.30 "	Journey .... 10 "								
					Total weights....	19	10	6	5	2	0

Average Times

	Loading	Journey Loaded	Tipping	Journey Empty
Motors	80 min.	30 min.	18 min.	27 min.
Horses	80 "	58 "	15 "	50 "

Average Weight of Loads

	tons	cwt.	qr.
Motor	4	15	0
Trailer	2	11	2
Horse vehicle	1	14	0

Summary

	Motor and Trailer	Horse Wagon
Cost per day	$7.92=27 cents per ton	$2.24=42 cents per ton

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It was again found that the vehicles were not comparing favorably with horse haulage, and with the object of obtaining better results trailers were adopted. Owing to the number of large horse team wagons available, these were utilized as trailers for the motors. Some little difficulty was experienced in getting these vehicles to track properly with the motors, owing to the fact that most of the weight came upon the rear axle, and only a small proportion on the front or steering axle. By arranging the draw-bar, however, so that the pull from the motor came upon the body of the trailer, and making use of the bar from the front wheels for steering purposes only, the difficulty was overcome, and the vehicles as now arranged give every satisfaction.

A local difficulty which arose may here be mentioned. It was found that young boys were much attracted by these vehicles, and that they would persist in attempting to ride on the short length of the draw-bar connecting the motor with the trailer. Notwithstanding repeated warnings several serious accidents occurred. This practice of the boys increased to such an extent that it became necessary to provide an extra man for the purpose of keeping them clear until the front of the trailer could be fitted with a semi-circular sheet of iron casing, so that no hold remained for the boys. The practice has now entirely disappeared.

With the object of enabling a fair comparison to be made between the operations of horse-drawn vehicles and motor wagons upon exactly similar classes of work in Liverpool, the following tables have been drawn up showing the actual times occupied when working between the same loading districts and depots over distances of about 2¼ miles.

Compared with horse haulage, it will be seen that the perfecting of the arrangements for speedy loading and discharging is of very much greater importance in the case of motors than of horse vehicles.

With heavy horses, such as are used in Liverpool, the average mileage traveled does not exceed 15 miles per day, and as this distance can be traveled in from five to six hours there is left an ample margin of time for the operations of loading and unloading.

With motor wagons, however, the mileage traveled is limited only by the legal limit of speed and the time available for running, and it therefore becomes very important that the time of loading and unloading should be reduced as much as possible, so that the time for traveling may be correspondingly extended.

By improvements in organization it has been found possible to arrange for the loading of the motor wagons and trailers—a total load amounting to about eight tons—in the same time as is required for loading the horse wagons, averaging about one and three-quarter ton, while it has also been found possible to unload the motor and trailer in approximately the same time as the horse vehicle; consequently a considerably greater tonnage is brought in than was originally the case in Liverpool.

A fair statement of the annual working costs of one of these vehicles, based on the present year's expenditures, would be as follows:

*Repairs, including proportion of renewals	$ 656.96
Wages of driver and assistant, including proportion of night men at depots	602.86
Fuel, oil and stores	269.20
Sundries, including insurance, establishment charges, and contingencies	118.80
Interest, 3½ per cent and sinking fund, based on life of ten years	303.00
	$1,950.82

*In the case of a new and up-to-date vehicle, the item for repairs and proportion of renewals might be fairly taken at $480, the other charges remaining the same.

Average number of working days per motor vehicle per annum, 245; average charge per day, $7.92 per motor vehicle.

Average inclusive charge for horse vehicle in Liverpool, including driver, $2.24 per day.

The following statement gives a fair comparison of costs over all the various distances which are usually collected to one depot in Liverpool:

	Cost per ton.
3-Horse Load Districts—2½ miles.	
4 motor wagon loads, with trailer, 29⅓ tons	27c
3 horse loads, 5¼ tons	43½c
4-Horse Load Districts—1¾ miles.	
4½ motor wagon loads, with trailer, 33 tons	24c
4 horse loads, 6¾ tons	33c
5-Horse Load Districts—1½ mile.	
6 motor wagon loads, with trailer, 44 tons	18c
5 horse loads, 8½ tons	26c
6-Horse Load Districts—1¼ miles.	
6 motor wagon loads, with trailer 44 tons	18c
6 horse loads, 10 1-5 tons	22½c
7-Horse Load Districts—1 mile.	
6 motor wagon loads, with trailer, 44 tons	18c
7 horse loads, 12 tons	18½c
8-Horse Load Districts—⅞ mile.	
6 motor wagon loads, with trailer, 44 tons	18c
8 horse loads, 13 tons	17c
9-Horse Load Districts—¾ mile.	
6 motor wagon loads, with trailer, 44 tons	18c
9 horse loads, 15¼ tons	14½c

The motor wagons are employed on the 3-horse load districts so long as there is sufficient work to keep them going, and otherwise on long distance journeys as is possible.

In ordinary work horses are used entirely for the shortest distance journeys.

On 6, 7, 8, and 9-horse load districts the carts are left for filling during the time the horse is running to the destructor depot and back.

FLAT AND UNINTERESTING

LEST it should appear that our opinions concerning the worthlessness of public motor trials were forced, and did not accurately reflect the prevailing sentiment both here and abroad, we reproduce herewith a brief extract from the report of a foreign contemporary which sent one of its representatives to witness the trials recently held in France, at which so few makers permitted their machines to compete:

"Lack of broad treatment is always reflected in the meagreness of entries, and we are obliged however reluctantly to declare that neither the trials nor the exhibition possessed the necessary or essential features to attract general notice."

Nothing equivocal about that.

Still every vehicle in the competition was awarded a prize. For what, do you ask? Why, because each machine traveled 38 miles a day, for seven consecutive days, loaded lighter and operating under more favorable circumstances that would be encountered in regular service, without hitch or interruption—all in a manner precisely as everyone with a particle of sense knew would transpire.

Service is the only test of motor wagons—just as motley is the only wear for stupid people who promote "dull" trials for them.

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Power Wagon Trailers

Axle Loads and Tire and Wheel Diameters Suitable For These Vehicles

AS there are signs that trailers will soon be employed in conjunction with motor wagons to transport merchandize in this country, it will be interesting to review the conditions which govern the use of trailing vehicles abroad.

It is popularly supposed, both here and abroad, that any horse drawn vehicle can be converted to use as a trailer for a motor wagon by merely fitting a spring draw-bar instead of shafts. In England this substitution is not permitted, for the excellent reason that trailers so procured would be destructive to road surfaces if their narrow tires were heavily loaded, as would certainly be the case if interchangeability of service were recognized as lawful. All trailers for motor wagons, therefore, must have tires of width suitable for the loads they have to carry. Furthermore, wheel diameters, axle carrying capacities and tire widths must correspond.

The regulations vary according to the weight of the trailer, and, curiously enough, also according to the weight of the motor that draws it. Firstly, the trailer must not exceed 7 feet 2 inches in width (measured over its extreme projecting points), if the motor is less than three tons in weight unladen; or 7 feet 6 inches, if the unladen weight of the motor is more than three tons. Secondly, it must be mounted on springs, if drawn by a motor exceeding two tons tare, but need not necessarily be spring-mounted if drawn by a motor of a less tare weight. Thirdy, the tires must be of a specified width and, if the motor is over three tons tare, the trailer wheels must be not less than 2 feet in diameter. Fourthly, the trailer must be fitted with an efficient brake acting upon two wheels—in practice always the two back wheels—on the same axle, and special arrangements must be made to apply these brakes. Lastly, the tare weight and certain other particulars must be painted on the trailer. The regulations as to the wheels and tires are watched by the police with great care.

Small trailers that are used behind wagons of less than two tons tare weight have to fulfil the same conditions as to wheels and tires as the motor itself. Hence, if the tare weight of the trailer is less than 1,500 pounds, there is no regulation as to width of tire; but, if it exceeds 1,500 pounds, and does not exceed one ton, it must have 2½-inch tires; while if it exceeds one ton, but does not exceed two tons, it must have 3-inch tires; or if it exceeds two tons, but does not exceed three tons, it must have 4-inch tires.

The rule which governs tire widths for trailers is as follows: There is to be a ½ inch width of tire for every 750 pounds of axle load, if the diameter of the wheel is 3 feet, but an extra 100 pounds is allowed for each 12 inches by which the diameter is increased above 3 feet, and a deduction of 100 pounds has to be made for every 6 inches by which the diameter falls below 3 feet, with a minimum of 2 feet. This makes the calculation somewhat difficult, especialy as the weight per ½-inch width of tire is proportional to the exact diameter, and does not step up at a jump every time the diameter of the wheel is increased by 1 foot, or decreased by 6 inches, as the case may be. There is a further regulation that the width of the tire is to be not less than 3 inches in any case. For the convenience of the police and users alike, who have to see that these regulations are fulfilled, exact tables have been added to the regulations, and a copy of them is herewith appended:

Width of Tire In.	Diameter of Wheel. Ft.	In.	Axle Weight not exceeding. Tns.	Cwt.
3	2	0	1	13
3	2	3	1	16
3	2	6	1	19
3	2	9	2	2
3	3	0	2	5
3	3	3	2	6½
3	3	6	2	8
3	3	9	2	9½
3	4	0	2	11
3	4	3	2	12½
3	4	6	2	14
3	4	9	2	15½
3	5	0	2	17
3	5	3	2	18½
3	5	6	3	0
3½	2	0	1	18½
3½	2	3	2	2
3½	2	6	2	5½
3½	2	9	2	9
3½	3	0	2	12½
3½	3	3	2	14¼
3½	3	6	2	16
3½	3	9	2	17¾
3½	4	0	2	19½
3½	4	3	3	1¼
3½	4	6	3	3
3½	4	9	3	4¾
3½	5	0	3	6½
3½	5	3	3	8¼
3½	5	6	3	10
4	2	0	2	14
4	2	3	2	18
4	2	6	2	12
4	2	9	2	16
4	3	0	3	0
4	3	3	3	2
4	3	6	3	4
4	3	9	3	6
4	4	0	3	8
4	4	3	3	10
4	4	6	3	12
4	4	9	3	14
4	5	0	3	16
4	5	3	3	18
4	5	6	4	0
4½	2	0	2	9½
4½	2	3	2	14
4½	2	6	2	18½
4½	2	9	3	3
4½	3	0	3	7½
4½	3	3	3	0¼
4½	3	6	3	12
4½	3	9	3	14¼
4½	4	0	3	16½
4½	4	3	3	18¾
4½	4	6	4	0
4½	4	9	4	0
4½	5	0	4	0
4½	5	3	4	0
5	2	0	2	15
5	2	3	3	0
5	2	6	3	5
5	2	9	3	10
5	3	0	3	15
5	3	3	3	17½
5	3	6	4	0
5	3	9	4	0
5	4	0	4	0
5	4	3	4	0
5½	2	0	3	0½
5½	2	3	3	6
5½	2	6	3	11½
5½	2	9	3	17
5½	3	0	4	0
5½	3	3	4	0
6	2	9	4	0
6	2	0	3	6
6	2	3	3	12
6	2	6	3	18
6½	2	0	3	11½
6½	2	3	3	18
6½	2	6	4	0
7	2	3	4	0
7	2	3	3	17
7½	2	0	4	0

The tire dimensions for power wagon trailers are considerably greater than for horse drawn vehicles.

The combined weight of motor and trailer must not exceed 6½ tons. That is to say, a motor wagon weighing five tons can only pull a trailer weighing 1½ tons unladen.

The axle weight of the trailer cannot exceed four tons.

Chester and Portsmouth are two English cities which are seeking Parliamentary authority to operate motor buses.

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Municipal Wagons

Economy and Variety of Service Yielded by Vehicles Owned by City Corporations

THE power delivery van of the Bradford City Tramways parcels department, illustrated in our last issue, is fitted with an 8 hp. gasoline engine. The chassis of the three vans in use cost $1,340 apiece. The bodies of the vehicles were made and fitted at the tramway depot. The maximum load of each vehicle is 1,500 pounds. The average loads are 1,000 pounds of parcels of various kinds.

Each working van runs about 80 miles per day, one starting at three o'clock and the other at eight o'clock in the morning, but both finishing up at seven o'clock in the evening. The longest worked vehicles perform the longest journeys. Stoppages are very numerous, so that it will be understood little time is lost by the vehicles.

Wages of Operators

A driver, who also acts as collector, is employed for each vehicle at a good salary, or else a driver and boy to collect parcels are employed at a like cost for each van. The vehicles have been employed for over a year, but a garage is only just now being erected for them. Until this is completed the vans, as previously, will be cleaned and repaired along with the electric tramcars. One man oversees all cleaning. One vehicle is kept in reserve; the other two work six days each per week.

Last year the three vans ran 639 days, between them an average of 213 each; or, leaving out one or other for repairs as occasion required, two vans ran 319 days each, more than an average of six days per week. One spare van to four constantly running will on these lines be sufficient, but at present the service has not been developed to this extent, although an immense quantity of parcel traffic awaits it.

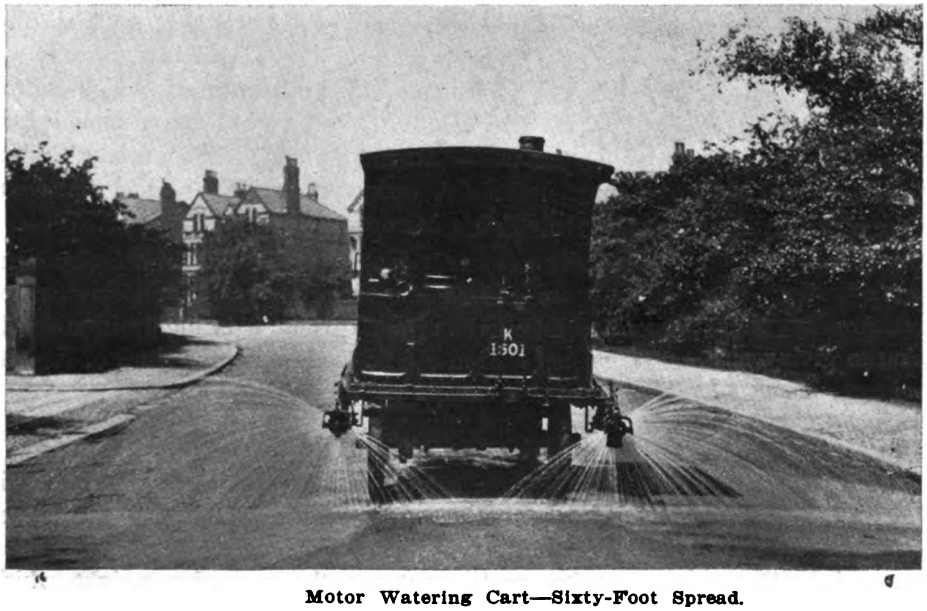
Tire Equipment and Cost

The tires on the front wheels are pneumatic; on the rear wheels solid rubber twin tread tires. The cost of tires for one year, including a spare set of four, amounted to $638.40 per vehicle. The rear solid rubber tires are guaranteed for 10,000 miles. The front tires are seldom renewed.

Tipping Dust Into the Destructor at Liverpool.

The cost of gasoline for one year amounted to $510.50. Lubricating oil for a similar period cost $84.50.

As the class of work is entirely new for the company there is no means of telling what it would cost to conduct the service by horses. The vehicles are not insured, and ten per cent is allowed out of revenue for renewals—thus reckoning on a life of ten years for the vehicles.



Motor Watering Cart—Sixty-Foot Spread.

The cost of a van per working day of ten hours is $5. The manager of the vehicles estimates that the power vans do the work of five horses and vans. Tabulated and completed the foregoing statistics will appear as follows:

INVESTMENT

3 vans at $1,340 each	$4,020.00
3 bodies for same at $100 each	300.00
	$4,320.00

OPERATING EXPENSES

Per Annum

Driver and collector, or driver-collector at $12.50 per week	$ 650.00
Cleaner at $7.50 per week	390.00
Tire renewals	322.00
Gasoline	510.50
Lubricating oil	84.50
Repairs	100.00
	$2,057.00
Standing charges:	
Interest and depreciation at 15% on capital	648.00
	$2,705.00
Management	500.00
	$3,205.00

As the three vans ran 639 days, 80 miles per day, the cost per mile was 6.26 cents.

The revenue accounts have not yet been prepared, but it is anticipated that they will fully justify the venture. Reckoning each van to run 213 days per annum, and absorb one-third of the total annual cost of the undertaking, each van would have to earn $5 per day. The lowest rate per parcel is 6 cents, and ninety parcels at this price clears expenses. Many more than this number of packages is carried daily by each van.

(*To be continued.*)

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Demonstrations vs. Service

Petty Advantages of Public Trials Pushed Forward While Disadvantages are Concealed

CASTING about for an opportunity to say something upon a subject momentarily interesting to manufacturers of power wagons, a contemporary, with more dash than judgment, eventually concluded to define the "art of truck demonstration." Struck by the forcefulness of the caption with which the article was ornamented, we were betrayed into believing that at last the sovereign remedy for a very grave trade disorder had been discovered. Hope vanished, however, the moment it became apparent the author was assuming that motor wagon construction was so imperfect as to make demonstrations imperatively necessary.

It is quite unnecessary to dwell upon the want of logic which characterizes such an assumption. It is enough to inquire how the sale of the machines, branded as imperfect, could possibly be aided by a demonstration of their defects. But let our ingenious contemporary present its own case, the foundation of which is as follows:

> Commercial trucks and wagons—a few good makes at least—are beyond the experimental state, but Motor Age does not believe that they have reached that point of perfection where a demonstration before selling is not necessary.

The timidity with which it is admitted that only a few power wagons are beyond the experimental state convicts the author of not having mastery over the essentials of his subject. We take it for granted that a device is commercially available as soon as it is demonstrated that it can be operated with economy. Any of the many power wagons now in the market, barring freaks, can be successfully put in service. Thousands of such vehicles are actually and profitably employed in service. Surely it is not to be assumed that, because these vehicles lack the structural refinements which will undoubtedly be observable in later models, their employment is of no advantage.

The disputed value of theatrical trials, exhibitions and the like have so powerfully affected some journalists of the pleasure car school that they fail to see how the power wagon can get along without the aid of such enchantments.

The *Motor Age* holds that the sellers of motor wagons must demonstrate their vehicle, and that, since this is so, demonstration should be to the masses and not to the few. This advice is founded upon the idea that it is economical to resort to the practice suggested. It is overlooked, however, that individual demonstrations are not nearly so numerous as our contemporary imagines. In fact there is a pronounced trade aversion to giving any demonstration except when a sale is imminent. Some of the more reputable makers resolutely decline to demonstrate, preferring to point to their vehicles which are in regular commercial service.

A badly sustained plea for public performances, competitions, trials, or what you will, concludes the *Motor Age's* article. Condensed it is as follows:

> There are at present sufficient dealers in motor wagons in many of our great cities to organize competition twice a year such as has just been completed in the north of France. Over two years ago a competition of this nature took place in New York, being conducted by the Automobile Club of America, from which beneficial results followed. Two years have elapsed since then, and the progress made in the design and construction of trucks and deliveries in the meantime is marvelous. A competition such as conducted in France—and she has them once or twice each season—lasts but a week or a few days more. It costs the makers no more than a week's demonstration for a prospective buyer—and look at the value of such a demonstration. Every mile traveled is observed by a score or more of interested buyers; being in competition with other machines, there is opportunity to observe the weakness and strong points of all, and authentic reports that reach the ears of millions are compiled from the performance, these reports being visible in scores of ways. Let American makers waken to the vast possibilities of these methods of popularizing commercial vehicles. They are cheaper by hundreds of dollars than the present method; they consume less time and do missionary work that cannot be done in any other way. Motor Age does not argue that individual demonstrations must not be made. They must continue, but judicious salesmen will minimize the time and money consumed by them.
>
> The road is open to tests and competitions, the only essential necessary being a spirit of unanimity among the various manufacturers and salesmen. The procuring of sanction for conducting a test is pretty much matter of form proceedings, and the success largely depends on the management of the controlling committee, the enthusiasm of the entrants, and the performance of the machines. The whole commercial car fraternity must rise to the occasion and put their shoulder to wheel.

Answers to the hysterical suggestions above presented are not far to seek.

The competition recently held in the north of France, to which our contemporary makes such admiring allusion, was a flat failure in point of public interest, numbers of entries, and numbers of establishments which participated in the competition.

The competition conducted by the Automobile Club of America two years ago gave absolutely no hint concerning the economy, reliability, durability, or any of the other qualities for the possession of which motor wagons are purchased. Of all the exercises intended to promote the power wagon industry this was the dullest and most unfruitful, owing exclusively to the shortcomings of the officials in control of it.

Until competent people, whose skill in the classification, uses and economies of motor wagon service are found to take hold of such trials, it is highly improbable that any impression can be made upon the mass of buyers.

GASOLINE-ELECTRIC RAIL MOTOR

DESPITE the adverse criticism of engineers in this country, the gasoline-eectric rail motor car is not wholly without friends. The chief objections raised against its employment are the excessive weight which

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such construction borrows and the increased cost of operation, as compared with either the straight gasoline or straight gasoline rail car.

The Hungarian government, however, has elected to overlook both of those disadvantages, and has just contracted with a well-known French firm, De Dion Bouton, for the manufacture of fifty cars of the mixed type. The accepted model weighs 18 tons and develops a speed of 62 kilometers per hour. The cost of fuel per kilometer was in the trial computed at 5 centimes per kilometer. In these machines a four-cylinder gasoline engine will be coupled to a 550 volt dynamo.

GASOLINE – PETROLEUM – ALCOHOL

MUCH is heard about the possible extinction of the gasoline supply. Consumers of this fuel, as well as those who have business ends to serve in ascribing its mounting price to scarcity, are for the moment unwilling to believe that any substitute but alcohol is worthy of consideration. It is instructive, however, to consider what has been accomplished with petroleum and other heavy oils.

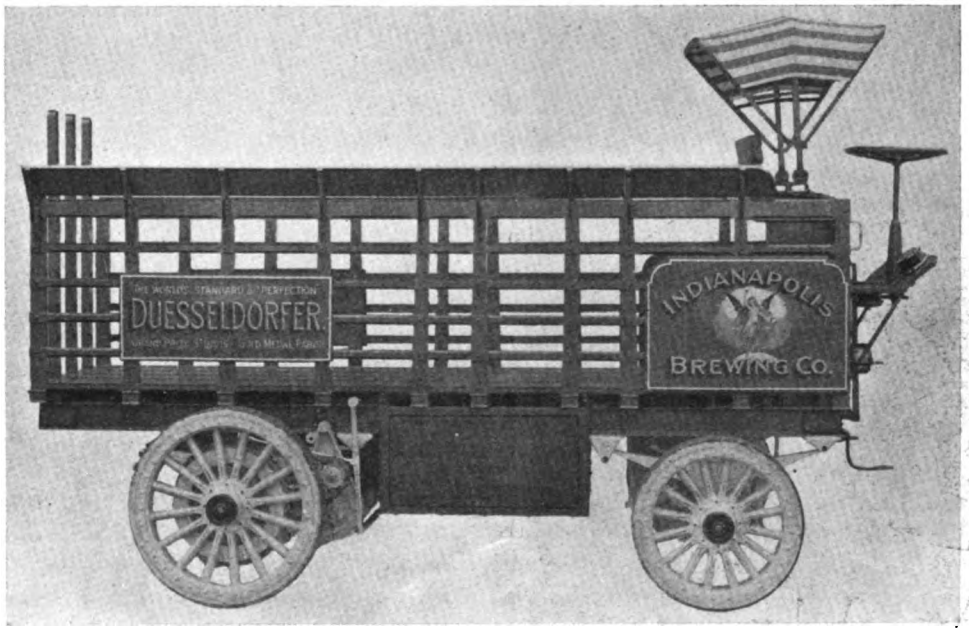
Petroleum engines are being built in large quantities for marine and industrial purposes. While all the problems attending their employment have not yet been solved they do not offer any more difficulties than those which, at the outset, delayed the general use of gasoline, or at this moment hinder the free use of alcohol. The petroleum engine develops more power than the gasoline motor for a given consumption. It is sweeter running, and is more easily regulated, for the reason that the exhaust is an infallible sign whether the engine is working properly or not. So long as the exhaust is devoid of smell the petroleum motor is running perfectly, and the driver has therefore always the means of knowing just when he has properly regulated his engine. It is true that the difficulty of starting cold still exists without a supplementary gasoline supply, but this will probably be overcome by the use of a self-starting device. Some petroleum engines can be easily started within an hour and a half of the time they stopped running.

The signal improvement which of late has been witnesed in vaporizer construction is a guarantee that even petroleum, cheap as it is, will not wholly monopolize the competition with its more volatile rival, but that heavy oils of many kinds will enter the lists for favor.

It is just as well to remember this when reading about the great future in store for denatured alcohol, the virtues of which the public prints are sounding so loudly since the passage of the act which removed the heavy tax upon it. There will be alcohol motors and alcohol carburetters. But there will also be gasoline-alcohol motors and gasoline-alcohol carburetters. And there will be heavy oil carburetters and motors.

There will even be other sources of energy than those now in process of development for internal combustion engines. Scientists are catholic in their researches.

It is of interest to observe that at the annual meeting of the stockholders of the British Electric Traction Company, the chairman announced the company's intention to employ motor buses to feed various parts of its street railway system.



Steel Tired 5-Ton Truck

THE Indianapolis Brewing Company, Indianapolis, is using the five-ton Pope-Waverly truck, shown above. It is the largest motor vehicle employed in that city. The truck is fitted with wide steel tires. It is used between the brewery and railway freight stations and between times switching freight cars for the brewery. Just now the truck is laid up for minor repairs, due to a collision with a street car. The street car, however, will have to be rebuilt. The Indianapolis Brewing Company maintains its own garage, charging being done by the company's lighting plant. A four-horse drawn truck has been put out of commission as a result of the purchase of the motor wagon.

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Wooden Tires

Maintenance of Rubber Tires too Costly for Vehicles at Work in Extremely Heavy Duty

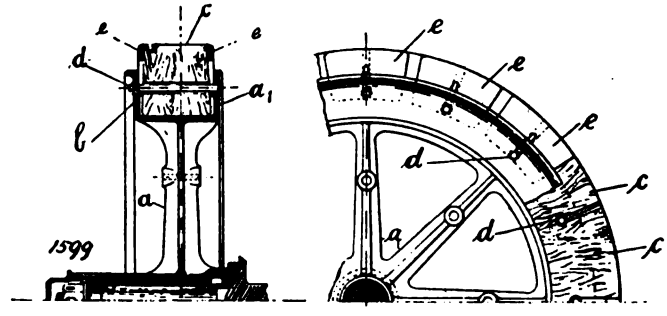
ONLY the most unreasoning of power wagon enthusiasts affect to believe that very heavy loads can be as economically transported on rubber tires as on wheels which are surfaced with wood or iron. This is not saying that six, eight and even ten-ton loads are not now moved by motor trucks having their wheels fitted with broad rubber strips, single or twin. But it does imply that practice, both here and abroad, although occasionally tolerating such equipment, is unable to justify it from the ledger point of view.

The use of rubber tires on light and moderately heavy vehicles is defensible from whatever point of view regarded, notwithstanding the high cost of maintenance. They do not in the slightest degree imperil the economy; rather do they contribute to it, since what they cost to maintain is more than compensated by the advantages they afford in the way of speed, cushioning and tractive qualities. But with wagons of the heaviest order, actively employed, necessarily moving at relatively low speeds, and habitually subjected to overloading, the economic problem is somewhat different. In the first place, their tires, if of rubber, are more costly to purchase, for they are not produced in such quantities as tires for the lighter vehicles. In the next place, the useful life of such tires is uncertainly calculated, the slightest increase in speed when excessive loads are carried resulting in astonishingly rapid wear, which is not indicated by the service of similar but smaller tires on lighter wagons. And, lastly, the benefits which such vehicles are believed to derive from the employment of rubber tires are more easily imagined than proved; while, on the other hand, the usefulness and economy of both wood and iron tires on trucks of this class is well established.

The Hunslet Wood Tire.

All this is a prelude to the introduction of the Hunslet wood tire, just patented, for which the following virtues are claimed: A perfect grip on greasy roads, great resiliency, economy in upkeep, with a long life, and easily renewable parts, which only have to be replaced after long use. The importance of these four factors will be admitted by all.

Numerous patents on wood wheels have been issued, both in this country and abroad. Their general characteristics are not strikingly different. They all aim at making rim sections interchangeable. This one is no exception. It is typical of its class. The central portion



of the wheel is a steel casting. The flange is integral with this casting. The other side of the rim has a removable flange. Blocks of hard wood (c) are placed in a continuous series in the rim, the grain running radially, and the inner ends of these blocks are wider on the cross section than they are at their outer ends, which form the tread. Segmental side plates (e) are provided to shroud portions of the wooden blocks which project above the flanges. The plates are slotted to receive bolts, which securely bind the loose flange, the slotted side plates, and the wooden blocks which make up the tread.

It is the common feature of tires of this class that, owing to the slight wedge-shape form of the blocks, they need no attention until such time as they are worn down to the level of the flanges. The side plates are automatically pressed inward as the wood wears, keeping the tread uniform, and preventing any splintering. A wheel such as this is cheap to produce, and, apart from the occasional renewing of the tread, will last indefinitely.

THE STORAGE OF GASOLINE

BY ordinance Chicago garage keepers are now permitted to store no more than 100 gallons of gasoline in tanks buried in alleyways or under the sidewalks. Furthermore, the municipal authorities reserve the right to order the removal or emptying of any tank which, in their judgment, is dangerously located. The harshness of this measure is in strong contrast with foreign municipal regulations which permit motor bus companies to store as much as 1,200 gallons of gasoline.

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MOTOR WAGONS FOR RURAL SERVICE

IN many rural districts the agricultural communities are looking to the motor wagon as a panacea for their troubles, and there is no doubt, where railway facilities are few or rates high, that the motor vehicle will enable them to get their produce to market with the least delay and at a low cost.

Farmers in Essex County, England, are making arrangements to supply London with agricultural produce by means of an organization which is to collect the various goods at centers situated in Chelmsford, Braintree, Dunmow, Epping, Ongar, Witham and many other towns. These collecting centers are to be furnished with slaughterhouses, chilling rooms, creameries and grading and selecting departments to deal with the produce brought from the surrounding country by motor wagons or horse wagons, and thence it will be forwarded to London by motor wagon. A somewhat similar system of collection is meeting with success in Berkshire.

Another promising outlook for the industry is the rumor that colliery owners are contemplating a system of direct deliveries of coal from pit mouth to consumer by motor lorry. It is remarkable that such a system has not been more in vogue where coal fields are within easy reach of industrial centers, as, for example, in Lancashire. The mode of procedure at present is for the colliery owners to load trucks on the railway, have them hauled from twenty to twenty-five miles by rail, unloaded to carts and eventually delivered to the consumer, sometimes three or four days being occupied in this manner, when by employing motor wagons as many hours would probably be occupied and the cost reduced to a minimum.

The present solution of the traffic problem in London and provincial towns no doubt lies in the employment of motor vehicles. It has been predicted that in London in ten years' time not a horse will be employed for traction work.—*Cassier's Magazine.*

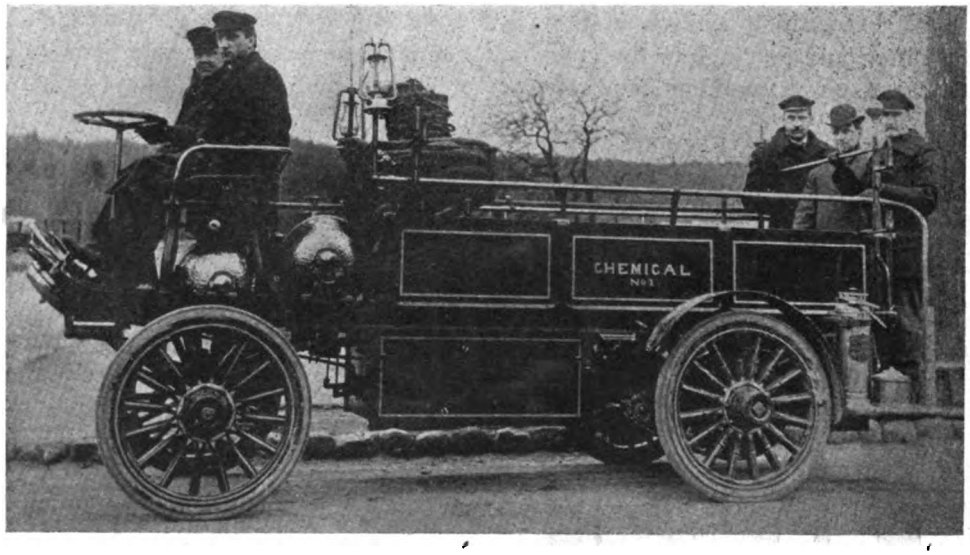
DEPENDABILITY OF MOTOR BUSES

EVIDENCE of the reliability of the gasoline motor bus is furnished in the experience of an observing foreigner with marked fondness for travel of the sort which that vehicle affords.

Between February 1, 1905, and July 1, 1906, he traveled 11,077 miles, or an average of a little more than 29 miles daily. During that period he only found it necessary to alight four times from vehicles on which he happened to be riding. In other words, involuntary stoppages only occurred once in every 3,000 miles.

INTERURBAN BUS SERVICE

INADEQUATE railway service between Stroudsburg, Dingman's Ferry and Bushkill, Pa., has caused the formation of a gasoline motor bus company in Stroudsburg to transport passengers between the points named. The fare is $1.50 for the round trip. Two trips are made daily. At present it is the intention only to operate during the summer and fall, but if the service proves popular it will be sustained throughout the year.



Electric Fire Vehicle

WHILE electrically propelled fire apparatus has long been employed in Europe, beyond an occasional runabout for chief's service, or an emergency wagon, but little use has been made of it in this country. Its value, however, has been sufficiently well proven to warrant its adoption as a unit of regular service equipment. Among the first to take advantage of this type of apparatus was the Hopedale, Mass., fire department, which last winter installed a Pope-Waverly combination chemical and hose wagon. The motive parts of the machine were constructed at the Pope plant, while the chemical outfit was supplied by the Howe Engine Company, of Indianapolis. In general appearance the vehicle closely resembles the regulation horse drawn machine. An Exide battery of 48 cells supplies current for two motors which drive the machine at a speed of 16 miles an hour. A thirteen per cent. grade is easily climbed even when the vehicle is fully loaded. A double chain drive is used. Aside from the necessary chemical outfit, 1000 feet of fire hose, hand extinguishers, axes, bars and miscellaneous tools are carried. Several men are also accommodated. The chemical tanks are placed in front. In a few seconds after an alarm is sounded the machine is on the street. Up to date this vehicle has proven very satisfactory. It is obvious that such a machine must necessarily be efficient to withstand the rigors of an uncertain New England winter.

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Their Attention

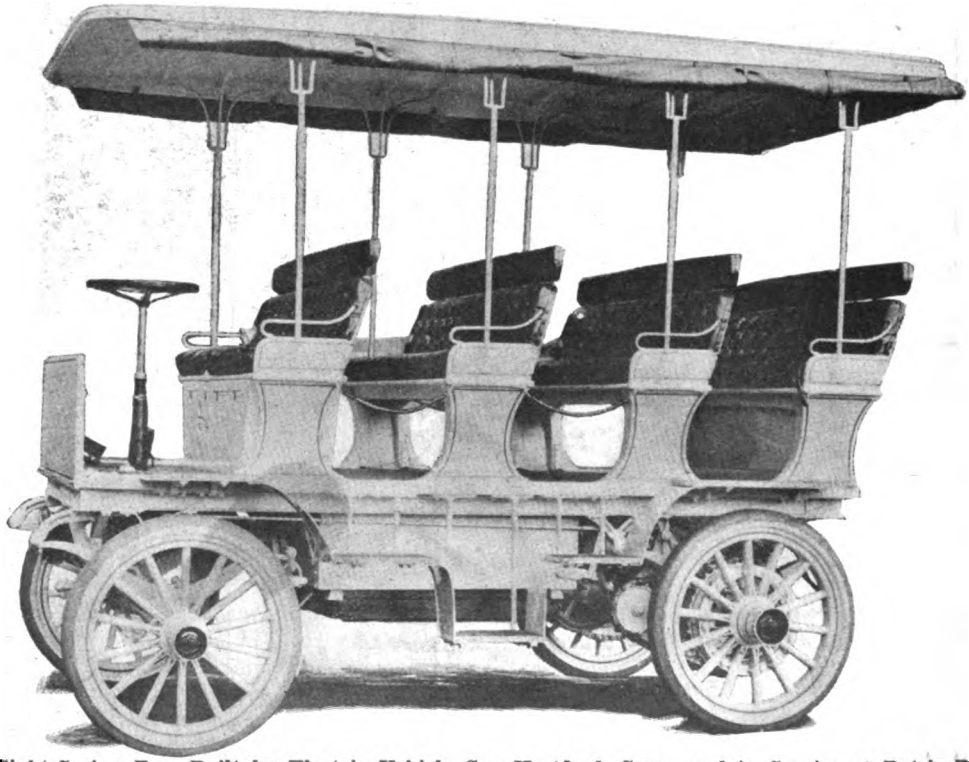
SOMETIMES a gravity feed carburetter will not supply gasoline when the machine is climbing hills which ordinarily do not cause any difficulty. Agitation of the float will not help matters. The supply pipe is not blocked. In fact the wagon will only mount the grade when the fuel tank is nearly full. As it is impossible to guarantee that all hills will be encountered with a tank nearly full, the difficulty may be remedied by fitting a back pressure valve and an air pump to the fuel tank, of course stopping up the air vent in the filling plug. This remedy is much simpler than attempting to raise the tank or lower the carburetter.

One Cause of Faulty Compression

One of the principal causes of the loss of compression is a bad seating of the inlet or the exhaust valve. The latter gives more trouble, as a rule, than the former, it having more work to do, and, moreover, has to withstand the great heat to which it is subjected by the outrushing exhaust gases at the end of each power stroke. It should be the invariable rule to examine the valves first. In no case should an examination of the exhaust valve be overlooked if the inlet valve is not found to be perfect. The signs of a worn valve are dark patches or pitting on the conical face of the valve or its seat. In many cases it will be found that the valve itself will be pitted and marked much more than the seat.

Another Cause of Compression Leakage

Another cause of compression leakage is the imperfect fitting of the piston and its rings in the cylinder. The ideal conditions for a piston working in a cylinder would be a perfect fit between the piston and the cylinder, but as the question of heat has to be considered it is not possible to attain this ideal fit, for if the piston were too tight the heat generated by its frictional contact would be so intense as altogether to prevent its working. As it is, the difference in measurement between the piston and the cylinder walls does not amount to approximately more than one-hundredth part of an inch. Although the hundredth part of an inch may seem a small matter, yet it allows of the escape of a very apprcciable quantity of the explosive gases from the cylinder before the charge is fired, and is of vital importance in the construction of an engine such as that employed in driving a motor vehicle. The piston, then, having of necessity to be smaller in diameter than the cylinder, it becomes necessary to make a gas-tight joint by the aid of piston rings. For this purpose, three or more rectangular grooves are cut in the upper end of the piston, and into each of these grooves is sprung a cast-iron ring so constructed as to have in itself a certain amount of spring which keeps it in constant contact with the walls of the cylinder, and so forms the necessary joint. In course of time these rings will wear to such an extent as to permit a portion of the compressed charge to escape, and, what is more destructive, portions of the ignited gas also escape by them, thus tending to their rapid destruction when once they begin to give way. It is invariably the top piston ring which gives way first, as this does the bulk of the work in preventing the passage of any part of the compressed or exploded charge.



Electric Sight-Seeing Bus, Built by Electric Vehicle Co., Hartford, Conn., and in Service at Put-in-Bay.

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Motor Bus Disaster

Driver Throws in Reverse While Machine is Rapidly Descending Hill and Accident Occurs

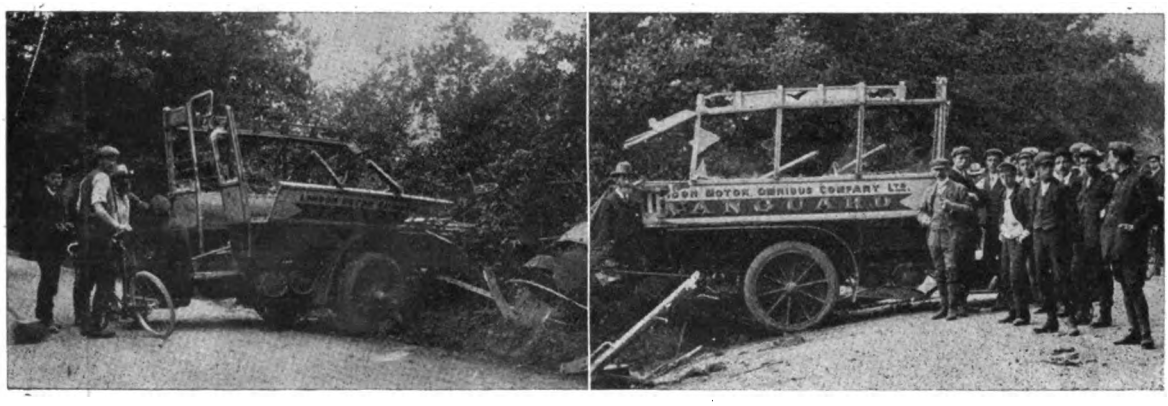
EXPERTS are nearly agreed that the motor bus catastrophe which occurred about the middle of last month between London and Brighton, and caused the loss of eight lives, might have been avoided if the driver had not been guilty of the unpardonable sin of throwing in the reverse gear while the vehicle was going downhill at a rapid and constantly accelerating rate of travel.

With both rear wheels locked and the five-ton machine (seven tons with passenger cargo) gaining headway every moment, the transmission shaft broke. Even if the driver had then applied the powerful road wheel brakes they would not have checked the descent of the vehicle, for by that time its ponderous mass must have been rushing to destruction at the rate of 30 miles an hour.

Doubtless it will develop under careful investigation that the driver, finding the vehicle moving too fast over the brow of the hill, took out the clutch and threw in the reverse gear, which action, however effective it might have been if the bus was moving very slowly on the flat, was wholly inexcusable under the circumstances.

Further than the driver's word there is nothing in the evidence thus far adduced to indicate that both foot and hand brakes were inoperative at the critical moment. The rigid system of vehicle inspection, which is so conspicuous a feature of the service of the company owning the ill fated machine, would certainly warrant a different conclusion.

Misfortunes which are accompanied by such lamentable losses of life have the qualifying merit of stirring professional interest in many matters of motor vehicle construction which, without their sorrowful consequences, would be left as we find them. The whole question of motor bus design is now being gravely considered. While there is no valid excuse for panic regulations to govern construction or operation there is undoubtedly room for improvement in the design of the vehicle as a whole and in its various component parts. Whatever may have been the true sequence of events, the lessons to be en-



The Top Deck and One Side of the Body Were Torn Away by an Overhanging Tree Bough.

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forced cannot vary very much. The failure of the brakes to act at the critical moment is no doubt the outstanding fact.

In all brakes usually fitted to motor cars the brake surfaces are out of action in the normal position. A true emergency brake would act on the reverse principle to those universally in use; that is, normally, the brake surfaces would be in contact, unless held out of action, say, by a wire actuated by the driver, by pedal or hand lever. Any accidental breakage causing damage to the emergency brake gear would then allow the brake to come into action.

Many gear boxes are made of aluminum alloys, the only virtue of which is lightness. In strength, toughness and reliability, aluminum alloys, generally speaking, are inferior to good quality cast iron. Public service vehicles should not be allowed to have untrustworthy material in any vital part. The fracture of some part of the transmission gear may have been the prime cause of the disaster, on the driver putting in the reverse. The reverse gear is usually lower than even the lowest forward gear, which means that the speed reduction from engine crank-shaft to road-wheel axle is then greatest. With the engine running at its normal speed, say 750 revolutions per minute, the reverse gear would drive the omnibus backwards at about three or four miles per hour. But if the forward speed of the omnibus at the moment of putting on the reverse gear were eight times as great (24-32 miles per hour) the corresponding speed of that portion of the shaft between the clutch and the gear-box would be eight times 750 revolutions per minute—i. e., 6,000 revolutions per minute. This speed has to be communicated practically instantaneously to this shaft in the reverse direction to its previous motion. A sliding gear of the usual type would be likely to have its teeth stripped one by one under this operation. The Panhard type of gear-box, now almost universal, ought to be replaced by one of the gears always in mesh type, at least on omnibuses.

Presuming that the change to the reverse had been accomplished without damage to any part of the transmission gear, and presuming, also, the engine to be running as usual with the clutch out, the two portions of the clutch would be running in opposite directions. If the clutch had been let in gradually, the engine would work against the down-hill motion, gradually bringing the omnibus to rest, and would then drive it slowly up hill. With a suitable clutch and transmission gear this gives a most powerful brake that will pull up a car on any hill up which it can be driven. Many clutches on London motor omnibuses are too fierce in action. A leather-faced clutch would be ruined by a few repetitions of the above operation. A multiple disc clutch is probably the best type to employ. For motor omnibuses the clutch should be of such a design that it can be used as above described without damage to itself.

It does not appear that the steering gear was damaged, but the driver is reported to have said that "there were outside 24 passengers and only eight inside; the result of this was that the bus was top heavy and began to sway all over the place." The side sway of the top heavy mass having been started, it would tend to increase, at one moment relieving pressure on one of the front steering wheels and causing a greater drag at the other. By the time the driver corrected this with the steering wheel the sway would be reversed, and so the unsteadiness would increase.

This brings us to a general indictment of the present type of double-decked London motor omnibus. To ensure a reasonable degree of comfort over bad roads the springs must not be too stiff. If the springs are easy enough to avoid transmitting road shocks to the omnibus body, on turning a corner the top of the omnibus sways outward, this action being proportonal to the height of the mass center. The omnibus traffic managers all prefer the double-decker to the single-decker on account of its greater earning capacity; but if it is to become a safe permanent type it will have to undergo some modifications. At present it is practically a heavy motor car chassis with an omnibus body added on to it.

The mass center should be kept as low as possible. The floor could be lowered nearly 18 inches, but this would mean a redesign of the chassis. The back axle would have to be bent, which would rule out of court the live axle, leaving practically only the side-chain drive. Whatever be the demerits of the chain drive, it has the virtue that chains seldom or never break; if from wear or bad design they become objectionable they are easily and quickly replaced.

The inspection problem in a motor omnibus company is entirely different from that in a locomotive shed. In a locomotive the designer keeps in mind accessibility; in a motor car or a motor omnibus, the vital parts, engine, clutch, gear-box, etc., are best completely encased. These concealed parts therefore should be of such design that they may run for long periods without being opened out. The engine and some types of clutches may be said to have arrived at this stage of development, and the gear-box must soon follow.

TESTED IN SCHOOL BOARD WORK

FOR some time past the department of education in Greater New York has been experimenting with motor wagons in the expectation that their employment in delivery of text books, supplies, janitor's materials, chemicals, etc., to the schools on Staten and Long Islands and in Westchester County, would be cheaper than draft animal service. Four firms making gasoline wagons have been called upon to give four days' test of their trucks. These tests have not by any means been perfunctory exercises. One machine was made to cover 100 miles in seven hours and a half loaded with supplies of the kind described and doing the work of three teams and wagons.

It is proposed to operate a motor bus line between Crystal, Palo and Belding, Mich. Public subscriptions are being raised for the enterprise.

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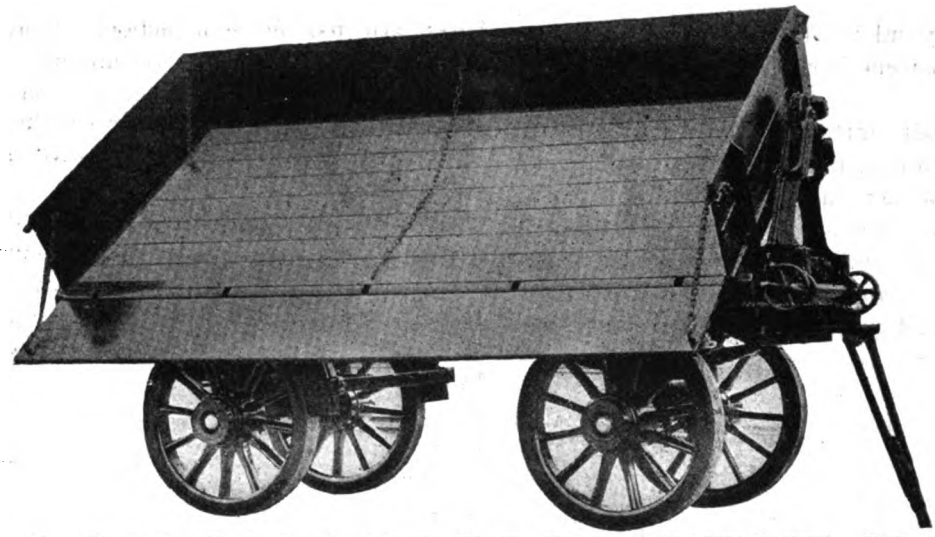

Trailer Constructed to Steer Itself Exactly in Track of Power Wagon. Can be Backed Into Position, Push of the Power Wagon Through the Coupling Rod Being Taken Only by Frame of Trailer, not on Fore-Carriage. Fore-Carriage Steered by Hand-Wheels Shown on Either Side

Trailer Brakes

Suitable Mechanism for Horse Drawn Vehicles to be Used with Power Wagons

NO study of the power wagon would be complete if it did not consider what eventual disposition was to be made of the many varieties of horse drawn vehicles now in service. Obviously these vehicles cannot well be converted into motor wagons unless it is assumed that the fore-tractor—a supplementary motive device which takes the place of the fore-carriage in an ordinary horse drawn wagon—can satisfactorily effect such a conversion. No engineer, however, will concede that this mongrel construction possesses any advantages which are deserving of serious consideration.

There remains, then, the alternative expectation of using horse drawn wagons as trailers for motor wagons.

In our last issue it was pointed out that the structural requirements of a motor wagon trailer are more severe than is ordinarily supposed. We now come to the consideration of some of the more important parts of the vehicle. Brakes naturally first engage attention. It is imperative that they be efficient. Foreign practice counsels the employment of brakes on both rear wheels. It is not sufficient that the brake should act on one wheel only, as is frequently the case with horse drawn wagons. The brakes must be strong enough to lock both wheels on one axle if required.

There are three methods by which these brakes can be applied: (1) they can be worked from the trailer itself, in which case a man must be on the trailer so as to be able to apply the brakes; (2) the trailer brakes can be connected to the power wagon brakes in such a way that neither of the two independent brakes, with which

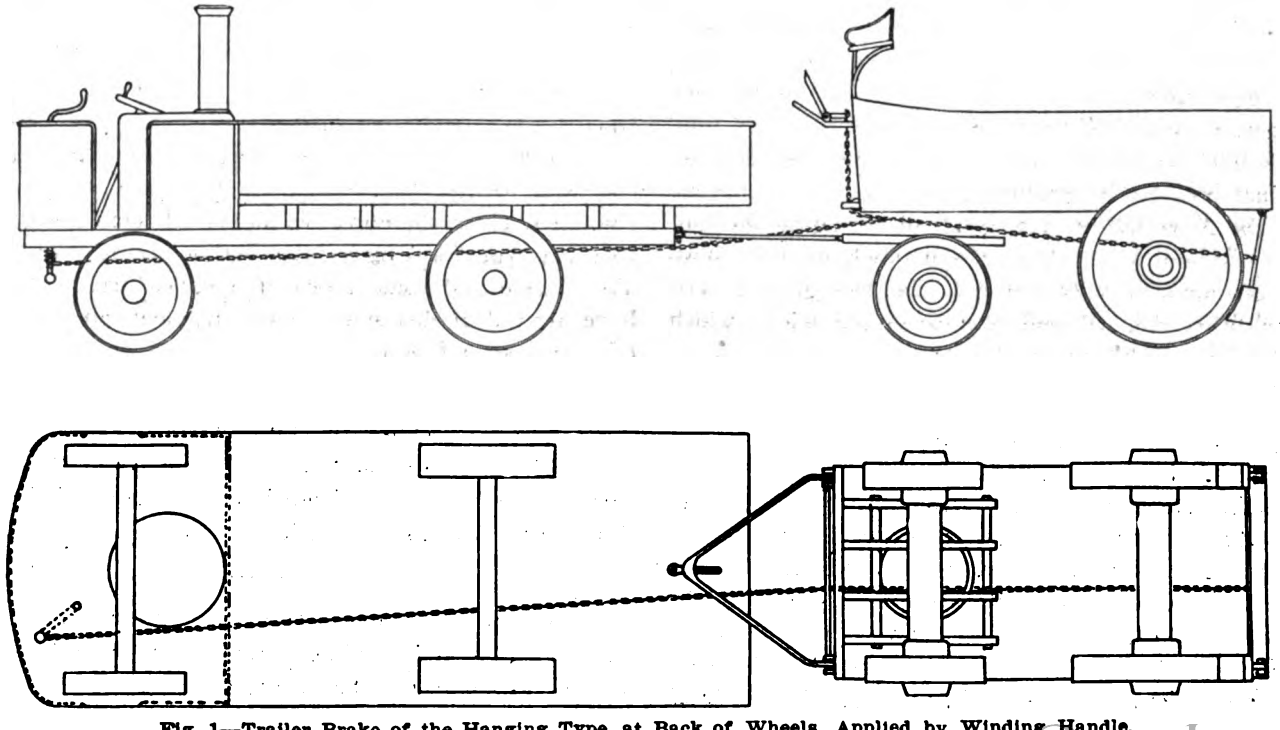

Fig. 1—Trailer Brake of the Hanging Type, at Back of Wheels, Applied by Winding Handle.

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a heavy motor wagon should be fitted, can be applied without at the same time applying the trailer brakes; (3) the trailer brakes can be arranged, either by connection to a separate handle on the motor wagon, or, as in the case of a tractor, by close juxtaposition, so that they can be applied from the tender foot plate.

If a horse drawn wagon is already fitted with brakes on each of two wheels on the same axle, it can at once be used as a trailer by carrying a boy on it who can apply the brake by the usual pedal lever, or by a screw and wheel. The seat of a trailer, however, is not the pleasantest place in the world when the engine of a gasoline wagon happens to be getting more lubricant than it needs or the fuel mixture is permitted to become too rich. Further than this, a boy perched in front of a trailer can be of no assistance in an emergency. As, however, his wages have to be paid, notwithstanding the trivial character of his duties, the plan of working brakes from the trailer should only be adopted when neither of the other two methods can be employed.

The second plan is quite out of the question where a steam wagon is concerned, because the two independent motor brakes are the hand brake and the reversing lever; so that whichever is used to stop the motor, the trailer will also be braked.

The third system is, therefore, the real alternative —an independent trailer brake applied from the driver's foot plate. There are several methods by which this can be effected. Figs. 1 and 2 show outline drawings of two simple methods, that in Fig. 1 being applied by a handle similar to that found on old street cars, and that in Fig. 2 by a vertical screw and nut. Either of these methods would be effective; it is only a question of which is the easiest to fit to the particular motor wagon. That illustrated in Fig. 1 is certainly the cheapest, but there may be no convenient place to fix it, and recourse must then be had to the other. In the method described in Fig. 1 an extra piece of chain, ending in a slip link, is joined to the existing brake chain, and left hanging when not in use. The slip link is coupled to the end of the chain on the motor, and it is not even necessary to disconnect the pedal.

The attachment of the brake to a trailer that is at present without one need not be a difficult matter. The commonest practice is to make a cross-bar, with a shoe at each end to bear on the wheel tires, and this is slung from the wagon frame. It is, however, very necessary to see that the hanging links are stiff enough to act as struts, as, should the wheels be turning in the direction which forces the brake upwards, these hangers would be in compression, and they have often been known to double up.

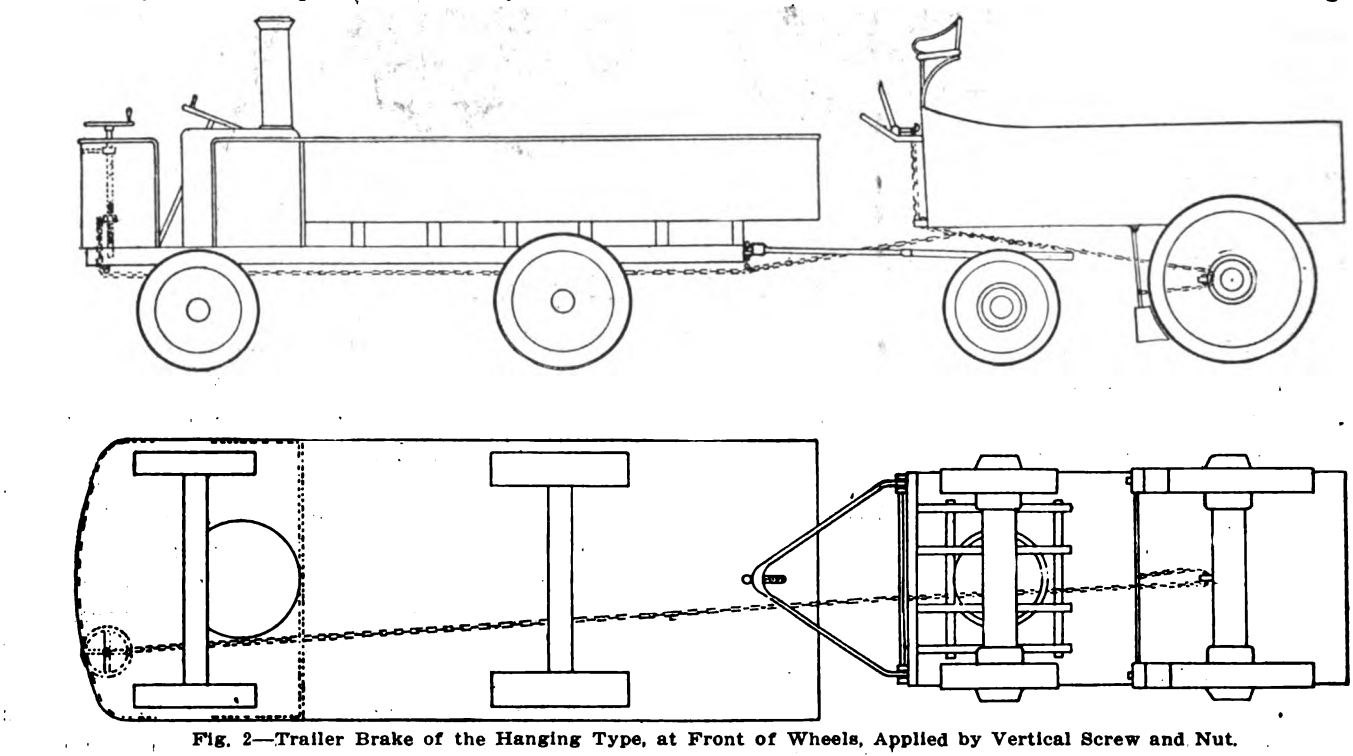

Fig. 2—Trailer Brake of the Hanging Type, at Front of Wheels, Applied by Vertical Screw and Nut.

PASSENGER AND FREIGHT LINE

THE Trinidad Automobile Transportation Company has been organized in Trinidad, Colo., with capital stock of $25,000, for the purpose of doing a general commercial business. Several 16-seated motor buses have been ordered. At the outset it is expected that the operations of the company will be confined to carrying passengers between Trinidad and some of the adjacent mining camps. Eventually, however, it is the intention to carry freight, express and mail matter.

Some time ago a motor tri-car was tested in British postal service. The car completed a trial of three months, running 360 miles a week in London, with the result that its performance is within one-quarter per cent of perfection. Such trials are not conducted in a haphazard manner abroad, and the above result represents in brief the conclusion drawn from an accurate tabulated statement of the test.

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MUNICIPAL MOTORS FOR CHICAGO

MOTOR garbage wagons may be seen in operation in Chicago before long. The city comptroller and superintendent of streets believe that much money is wasted in hauling refuse to the reduction plant by horse drawn wagons and will probably recommend the employment of power vehicles in their stead.

Under the contract recently signed by the city for the reduction of the garbage the city must deliver all garbage at the reduction plant in airtight tanks or specially constructed garbage wagons or cars. Arrangements for the equipment of a municipal teaming system to handle the hauling of the garbage have been under way for several days, but the officials have found great difficulty in securing the necessary horses.

The comptroller is not specifically informed concerning the economy to be derived from the employment of motor garbage wagons, but he reasons that if merchants can use motor vehicles with success in transporting their merchandize the city should be able to find profitable work for them. He says further:

"I believe it would be wise for the city to install enough automobiles, built with airtight garbage tanks, for the hauling of the refuse rather than to try and put in a municipal teaming system. I am confident that heavy, well-built trucks will carry more garbage than a team of horses can haul, make better time and prevent the necessity of sending a large part of the garbage from specially erected stations by railroad to the reduction plant.

"Horseflesh is so sarce and so expensive that it is going to be very costly to the city if we have to buy sufficient teams to handle the garbage. We can have automobiles built so that they will carry the garbage in a thoroughly sanitary manner and transport all our refuse on these machines. One of those big machines can carry an air and water tight tank with a capacity several times larger than a wagon tank which a team of horses could haul. These tanks can be lifted by derricks from the machines into the reduction plant vats, emptied and placed back on the machines without any difficulty."

THE DISAPPEARING HORSE

NOWHERE in the world is the rapid shrinkage in draft animal service, caused by the catholic use of commercial motor vehicles, so strikingly noticeable as in London. One year ago horses fairly rioted in the command of its principal thoroughfares, so far as mere numbers are concerned. Today, however, the evolution in minor transportation having completely burst the bonds which restrained its development, the numerical ascendancy of the horse in certain well favored traffic districts is diminished by fully 40 per cent.

In effecting this astonishing transformation the motor bus, not unexpectedly, has played a principal part. Its ubiquity is a matter of universal comment. Commercial motor vehicles of other kinds, however, have contributed not a little to the change.

Observing both forms of omnibus traffic from a vantage standpoint giving command of a favorite thoroughfare, a census expert recently ascertained that horses were disappearing so rapidly as a result of the competition of motor vehicles as to make it impossible that animals would be employed much longer than the present year. Condensed this is what he discovered:

Periods of Observation	Motor Buses	Horse Buses
3 hours	211	249
6 hours	408	586
9 hours	609	896
12 hours	805	1,222

One year ago, when a similar census was taken at the same point, the twelve hour count only showed 361 motor buses in motion.

Another highly interesting comparison which this statistician drew between motor vehicle and draft animal traffic is here submitted:

Motor road vehicles, all kinds counted in

	1906	1905
12 hours	745	234
Horse vehicles, all kinds counted in 12 hours	928	1168

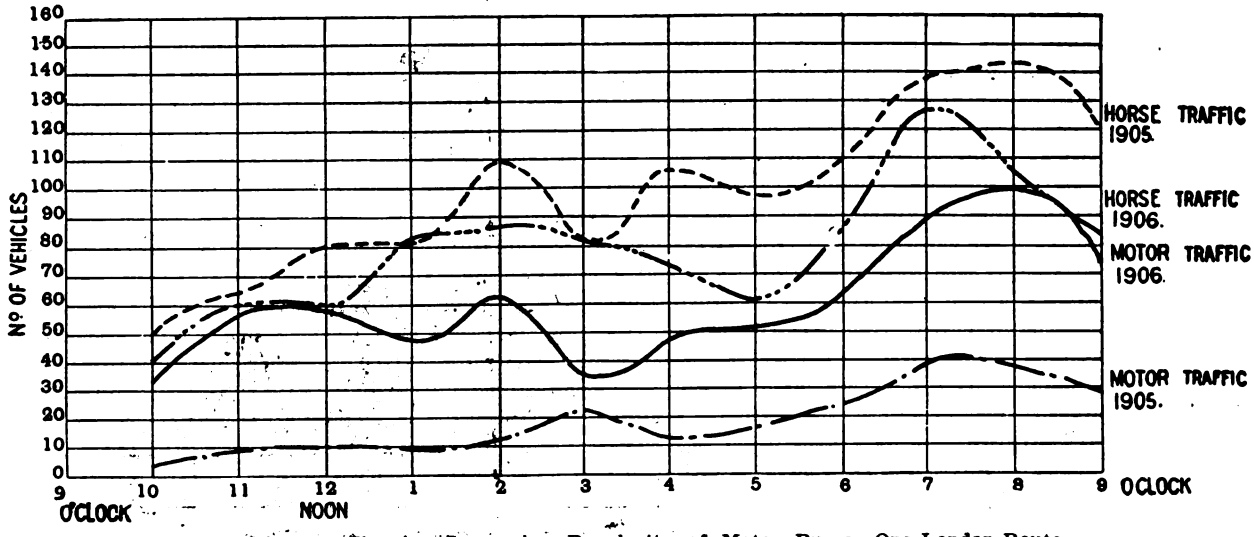

Diagram Showing Increasing Popularity of Motor Bus on One London Route.

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Municipal Wagons

Economy and Variety of Service Yielded by Vehicles Owned by City Corporations

(Special Correspondence)

POWER ambulances are beginning to find a vogue just now in Great Britain. The London County Council after many deliberations has agreed to ask Parliament for power to establish, at a cost of $26,000, two stations for such machines. The Metropolitan Asylums Board of London, alread has in use two motor ambulances driven by gasoline 4-cylinder 16 hp. motors. They are fitted with self-starting devices operated from the driver's seat. Another type of motor ambulance now being constructed for the Board can be converted so that convalescents may be taken out for airings or to their homes.

Motor Tower Wagons

Motor tower wagons for use in connection with overhead electric railway equipments are being increasingly used by British municipalities. Indeed the uses to which such vehicles may be put are manifold. They can be used as water towers by firemen, the hose being raised with the telescopic ladders. The staging gives the firemen a good range of action. The vehicles are also useful for men engaged in recarboning arc lamps, repairing telephone or telegraph wires, cleaning tower hall windows, painting bridges and many other purposes which will suggest themselves to the ingenious mind.

In 1902 the Leeds Corporation paid $3,750 for a 4-cylinder 18 hp. gasoline chassis upon which was erected a tower costing about $375. Repairs are trifling, consisting chiefly in the replacing of solid rubber tires as they wear out. The tools and appliances carried on the wagon, together with the men, make up a load of about 2½ tons.

Economical Vehicles

The Bradford Corporation, besides the parcel vans already described, owns and operates two gasoline tower wagons. The first, with 8 hp. 2-cylinder motor was purchased without the tower four years ago at a cost of $2,500. The tower cost about $250. The second with 18 hp. engine, cost, three years ago, $3,350 for the chassis and $375 for the tower. They are used for erecting and maintaining the overhead street railway equipment, carriage of tools to various parts of the railway system, and generally for emergency and breakdown work. The average load with tower is about 3¼ tons. The maximum speed of the vehicle is 15 miles per hour. When not in use the driver is employed in the railway repair department. The corporation engineer is quite satisfied that the economy of the vehicles, although of the earliest type, is considerable. No record is kept of the work and cost of running the machines, the only noticeable item in upkeep being renewal of solid rubber tires, as with the Leeds corporation tower wagon. In all heavy vehicles of this class the cost of tire maintenance works out at about 3 cents per mile.

The Glasgow Corporation uses a 12 hp. gasoline 2-cylinder tower wagon. The chassis is similar to that of the three lorries used by the London County Council tramways department, and which will be presently described. The cost, complete, was about $3,500.

The Belfast Corporation has recently purchased a 22 hp. 4-cylinder gasoline tower wagon. The maximum height of the platform from the road is 20 feet and the minimum elevation 12 feet. Two tool boxes are placed on the rear of the tower, one below the other. A second seat behind the driver is provided for the accommodation of three mechanics or assistants. The price, complete, was $3,750.

Motor Wagons Save Time

Newport also recently purchased a horizontal gasoline engined tower wagon. The arrangement of the engine permits of the whole length of the platform being used for the tower and repair equipment. Previous to delivery the machine was subjected to a test breakdown call in competition with the old two-horsed tower wagon. Both vehicles turned out on a telephone call and proceeded to a spot 5 miles distant. The gasoline vehicle had its men at work actually handling the overhead wires seven minutes before the horsed wagon appeared in sight.

Aberdeen purchased an 18 hp. 4-cylinder two-ton gasoline lorry chassis at a cost of $3,500. The tower erected upon the chassis cost $375. The vehicle costs about $600 per annum to keep running, including interest on capital outlay, depreciation, drivers, repairs, sundries, insurance and stores. The driver's time, when not employed with the wagon, is charged to the particular branch of railway work he is engaged in.

Motor Tower Wagons Indispensable

Newcastle-on-Tyne and other cities have gasoline tower wagons, but they all cost about the same figure when complete, viz.: $3,500. The usual load is 2½ tons, and the cost of running, upkeep and standing charges varies from $550 to $650 per annum according to the extent of the system the vehicle is attached to. All municipal traction engineers are agreed that the power tower wagon is indispensable to large electric tramway systems.

The London County Council street railway has no use for tower wagons, as all its lines are equipped on the conduit system. However, it uses gasoline motor chassis such as are employed by other cities for tower wagons. The London County

British Gasoline Tower Wagon.

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Council wagons are of 12 hp. with two cylinders, carry 3-ton loads, and travel up to 16 miles per hour. Three of these vehicles have ordinary float bodies, as illustrated, and are employed to carry stores between the depots and in the removal of old horsed street cars to purchasers, or to the repair shops if not dispensed with. The disused equine chariots are run up on plank slopes to the beds of flat trailers. The fourth wagon is fitted with a van top, and is used in breakdowns. The van top is removable and can be fitted to either of the other power vehicles if desired. The breakdown van usually occupies ten minutes to cover two miles. The breakdown gang consists of a fitter and two assistants with driver. The kit includes ten jacks of from 1 to 15 tons capacity, two bogie trolleys towing chains and ropes, crowbars, wedges, sledges, and a line testing apparatus. The major portion of the kit is stored beneath the seats running each side of the van. Solid rubber tires are fitted to all the vehicles, which cost $3,250 each.

Municipal Motor Buses

In the matter of operating motor buses British municipalities have not been too eager. Eastbourne has had a fleet for several years, but owing to the difficulty of finding suitable routes did not obtain much profit from them at first. Wolverhampton was the next to experiment. Its engineers of the corporation street railway, to which the motor buses were to act as feeders, drew up the following estimate of the cost of operating three motor buses:

Operating Charges

Cost per bus mile.

Gasoline,	2.6c
Wages of driver and guard, etc.	4.10c
Wages of oilers and cleaners	4c
Tickets, light, etc.,	552c
Oil, grease and sundry stores,	4c
	8.052c

Maintenance and Renewals

Tire renewals	4.0c
Rolling stock	1.850c
	5.850c

Twin Tire which has been run upwards of 18,000 miles on the rear wheels of Motor Bus weighing five tons.

General Costs

Rates, insurance and miscellaneous	6c

Capital Charges

Interest and depreciation	4.6c
Grand total	19.102c

Experience Reduces Operating Costs

The figures on the whole were fairly representative at the time they were drawn up, but the cost of motor bus operation has decreased since that period in consequence of the many improvements in mechanism and greater experience in running the vehicles. Wolverhampton's buses were run on a route where there are many hindrances to the laying of a street railway track. The three vehicles gave a 15 minute service. The buses were housed in the electric car shed so that no extra car building was required except the erection of a gasoline storage tank.

The foregoing figures were based on an annual mileage of 74,000, or 24,666 2-3 miles per bus, a very good average if the time occupied in docking the vehicles systemically for overhauling is considered and Sundays are regarded as off days for all vehicles.

Impediments to Progress

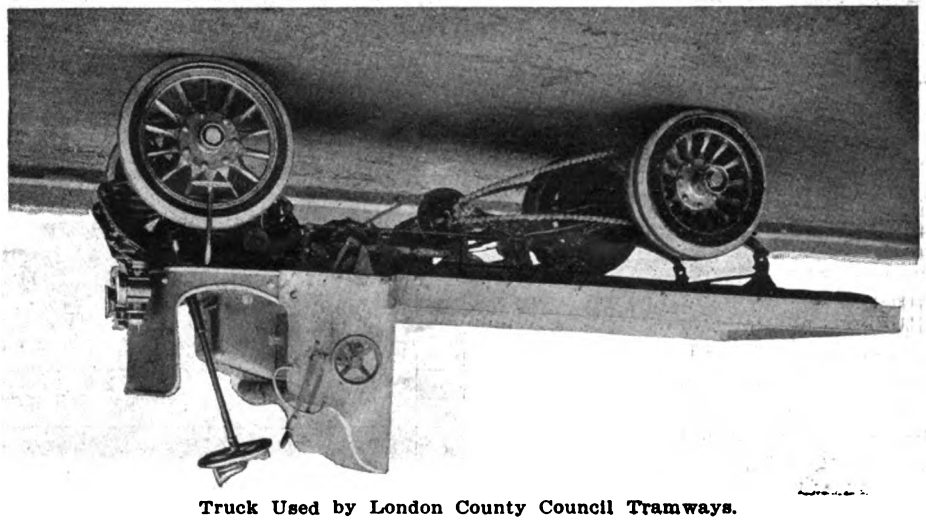
There is a great desire among British urban district councils to run, or obtain permission to run, lines of motor buses in their districts. This permission is not always given, in view of the right of the private public to serve the general public if they so desire. Without special parliamentary powers, urban district councils cannot improve the road transport facilities of their respective districts. They are empowered to license motor buses and to make by-laws regulating their management, but if a council wants to run buses it must promote a bill in parliament conferring these powers on the council. The success such bills meet with is not very great.

Private enterprise is the only alternative, but the councils may exercise their powers to assist any scheme to the public advantage and contribute sums in aid thereof. Now and then a council plays the dog-in-the-manger and refuses to license motor buses to be run by private persons, although they cannot run the buses themselves. In every case where this has so far occurred, however, public opinion has been too strong for the councils and they have had to grant the licenses asked for.

Leeds City has several motor buses, and half a dozen other municipalities are applying for powers to run similar vehicles. The difficulty of obtaining the power to operate keeps back many applications which would otherwise be made.

Motor Bus Costs

A full size motor bus to carry 36-passengers costs $4,250, complete with body and tires. Acetylene lighting, or electric lighting, and rattan seats are extras. Oil lighting and plush or leather seats are included in the price mentioned.



Truck Used by London County Council Tramways.

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First Municipal Wagon Used in Liverpool—Vintage of 1899.

Seven Years' Experience

Conclusions of an Eminent Engineer Upon the Utility and Construction of Power Wagons

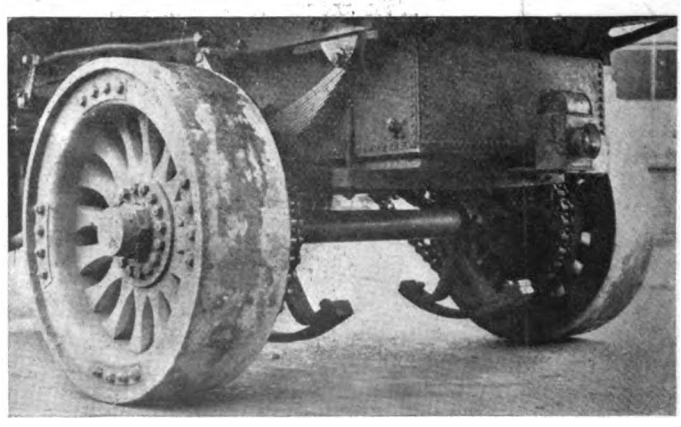
MANY passages in the paper read by Mr. Brodie before his municipal colleagues indicate that he is a safer guide when adhering strictly to matters within his domain than when making short excursions into realms which manifestly he has not explored to any great extent.

For example, he does not balk at saying that steam or gasoline vehicles are pre-eminently useful as motor ambulances. The limited experience which Britons have obtained from the use of electric vehicles does not enable them to perceive the special merits of such machines for this particular class of service. Noiselessness, freedom from vibration and smoothness in operation are essentially the characteristics of the electric machine. It may be that one such vehicle in a hospital not specially equipped to give it adequate care and attention would prove more costly to maintain than either a gasoline or steam machine, but this disadvantage is more than balanced by the certainty with which it operates, the rapidity with which it can be put into action, and the comparative ease with which electric vehicle drivers can be picked up.

Furthermore, the smoothness of operation and the absence of noise and vibration, upon which Mr. Brodie rightly lays such stress, would at the end of a given period of service by an electric machine be quite as noticeable as at the time of purchase, while it might reasonably be expected that the gasoline machine, however perfect at the outset, would before long manifest contrary qualities. The steam machine possesses the disadvantage of being unable to get under headway within as short a space of time as either of the other vehicles; otherwise its noiselessness in operation would be as permanent as in the case of the electric machine.

The recognition of this has led the majority of competent investigators to award the palm of superiority to the electric vehicle in ambulance work in all cases except those where speed and vibration are matters of small importance.

While on this subject it will do no harm to further modify the opinions expressed by Mr. Brodie by drawing attention to the singleness of purpose which his whole paper breathes. He is, as is evident, a warm advocate of both gasoline and steam vehicles for municipal service. To what extent electric vehicles might be employed by the Liverpool corporation can, of course, at this distance only be conjectured. It would appear, however, that from the stated range of Liverpool's municipal motor wagons the work they are performing could, from a mechanical point of view, be accomplished just as satisfactorily by electric vehicles. It is not certain, however, that their maintenance would be as low as Mr. Brodie shows the maintenance of steam and gasoline wagons to be, unless the entire motor service of the corporation was



Old Type Straight Axle Used on Municipal Wagons.

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performed by electric machines, in which event the stable economy alone would justify at least the consideration of this type of wagon.

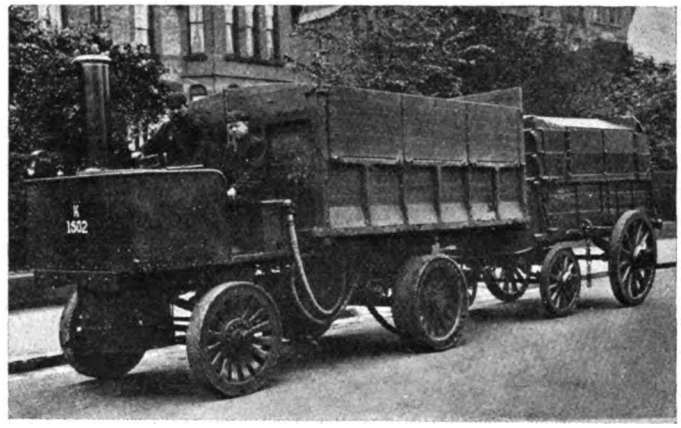
Years ago some particularly skillful stock jobbers and market rigging operators on this side of the water joined forces with people equally dexterous on the other side to exploit electric vehicle road traction. The collapse of the enterprise, the bad performance of the vehicles, and particularly the savage resentment of investors, all conspired to give the electric machine a notoriously bad name in Great Britain.

The effects of this ill starred enterprise are felt to this day in England, and notwithstanding the enormous commercial success which has attended the use and manufacture of electric vehicles in this country, its significance is either unknown or ignored by British users or makers of commercial motor vehicles. This wholly explains

Steel Sheathed Double Pneumatic Tire, Used for 5000 Miles on Heavy Municipal Wagon.

British disinclination to pay the slightest attention to the demonstrated advantages of the electric machine.

Notwithstanding these lapses, however, the expertness of Mr. Brodie's opinions concerning the larger economic principles involved by the use of motor wagons is not to be denied. The breadth of his experience alone entitles his utterances to more than common consideraton. Although he touches lightly upon the stable economy to be derived from the employment of motor wagons, it is evident that he regards it as one of the most important divisions of the general study. Few establishments which are making use of motor wagons today have been enabled from experience to reach the conclusion so definitely stated by Mr. Brodie—that in the mere matter of stable room the substitution of motor vehicles for horse drawn vehicles effects an economy of fully 50 per cent. The value of this admission is best understood by a calculation of the cost of the real estate upon which horse stables are erected, and the high cost of buildings thereon.



Municipal Dust Wagon and Trailer.

The second installment of Mr. Brodie's paper here follows:

When occupied on street watering the following gives the time required in the various processes in Liverpool for motors and for horses working under exactly similar conditions:

	MOTOR. mins.	HORSE. mins.
Time occupied from depot to hydrant	10	30
Time occupied from hydrant to depot	10	30
Fixing and taking off tackle for loading	1½	3
Time occupied for loading	3	3
Time occupied for distributing	4	6
Time occupied for travelling	4	6
Time occupied getting to hydrant empty	½	1½

Motor Wagons For Street Watering

On dry days a minimum of 40 horses is usually employed upon street watering, the average useful mileage per day obtained from these horses amounting to about eight miles. On the driest and hottest day a maximum of about 75 horses is employed, which at the same average mileage gives a total of 600 miles of useful watering.

The motor wagon at present in use in Liverpool for street watering sprinkles the whole width of a 32 ft. road in one operation, as compared with a width of 16 ft. by the horse vehicle. This increased speed has been attained by lifting the tank, but it may also be obtained in the case of motor vehicles by the lift-pump arrangements, recently introduced by Messrs. Glover, of Warwick, in which the head is kept constantly at a level greater than the natural fall due to the level of the water in the tank.

Rubber Tired Wheel for Municipal Wagon.

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By the improved width of spread possible the mileage can be practically halved as compared with water distribution from a horse vehicle. The motor watering wagon in Liverpool is kept at work on an average for a period of 20 hours per day, and assuming that an average speed of six miles per hour can be obtained—which is practically what is accomplished in actual practice—the length of street dealt with by motor wagon amounts to 35 miles for two shifts with 32 feet of spread, equal to 657,000 square yards, and on this basis it displaces approximately eight horses.

Assuming that the total charge for the motor wagon per shift amounts to $7.92, the total cost of watering a mile of road averaging 32 feet in width would amount to 44 cents with motor per day and 54 cents with horse per day.

Other Advantages of Motor Sprinklers

In the case of motor watering, in addition to speed, the following additional advantages may be claimed for the motor, viz:—

1. That as the load is so much greater a proportion of the time lost in connecting and disconnecting to hydrant is saved.
2. That a proportion of the time lost in running to hydrants is also saved; and
3. That owing to the weight and stability of the vehicle, the load may be carried at such a height as to treat roads of ordinary width in one operation.

With regard to the question of street sweeping by means of a revolving brush attached to a motor vehicle, it appears somewhat questionable whether any great advantage from an economical point of view is obtainable under ordinary conditions, as the speed of the motor must be kept low and consequently the work done does not exceed twice that done by the horse vehicle: whereas the proper charges for the motor wagons must exceed the cost for two horse vehicles.

In connection with street sweeping there appears to be an opening for a combined motor sprinkling and sweeping machine, but it should be capable of sweeping a track at one operation considerably wider than the ordinary horse brush, and, if possible, it should also be capable of lifting the materials collected by the brush and depositing them in the body of the wagon.

Speed, Tires and Trailers

The work which comes under the control of the surveyor is so variable in character that attention should perhaps be called to two developments in motor traction which will no doubt be found useful where the conditions are suitable, viz.:

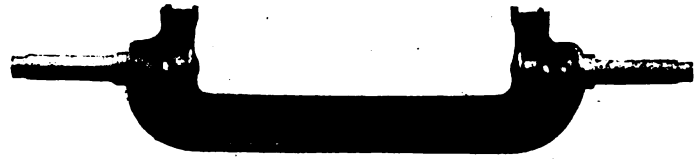
1. The medium weight gasoline wagon on rubber-tired wheels, and
2. The light tractor

All-Metal Wheel for Municipal Wagon.

In many districts strong objection is offered to the use of heavy wagons with iron-tired wheels, and in some cases no doubt authorities will consider that the advantages of freedom from vibration and noise, together with the greater speed, viz., 12 miles per hour, allowed to such vehicles will more than counterbalance the advantages of economy possessed by the heavy motor wagon, and it appears likely that there will in the near future be a considerable development in this direction.

The light tractor is also at the present time considerably in evidence, and, where the conditions of loading and unloading are such that the wagons cannot be quickly loaded, or where there may be considerable delays before the material can be delivered on the site of the works, they will no doubt be used.

It appears likely, however, that the motor wagon and trailer will be more economical in working for urban purposes generally.



Latest Cast Steel Rear Axle for Heavy Municipal Wagon.

Motor Ambulances

The work done by ambulances, viz., the removal of sick and injured people to the hospitals, as also the removal of infected clothing to the disinfectors, and its return after disinfection, appears to be specially suitable for more than one class of work, and there are now several methods by which the one vehicle body can be quickly removed and another placed in position without delay.

Steam vehicles have been recommended for this class of work largely on account of their quietness and smoothness in operation. Where, however, used for emergency purposes, many four-cylinder gasoline engines are now almost equally silent and free from vibration, while they have the additional advantage of always being ready for work at a moment's notice if kept in good condition.

Motor Fire Vehicles

Another branch of work in which the motor must in the near future displace horses is in the service of the fire brigade, and in this line already a fire brigade can hardly be considered up-to-date which does not contain samples of motor-propelled vehicles.

In no branch of the municipal service is promptness in starting and speed on the road of greater importance than in connection with an outbreak of fire. In many cases fires which would otherwise have developed into large conflagrations have been avoided by the early arrival of the motor wagon.

In Liverpool there are at the present time, under the charge of the head constable, three automobile fire engines and one motor tender, and the following extract from his annual report puts very concisely his opinion of the merits of the motor vehicle for such purposes:

"The economy of these in place of horse-drawn machines is manifold; those which are equipped with chemical cylinders, as two of the present are, and all the new ones will be, supply the place of both a first-turn machine and a steamer, while the substitution of oil fuel for coal practically does away with the want of a tender, the tanks carrying enough oil for a fire of anything but exceptional duration. The one machine may, therefore, be said to take the place of three machines and three pairs of horses, while the gas for keeping up steam costs no more than the bare forage for one pair of horses. The driver on arrival at the fire has no horses to look after, and is available as a fireman."

Stable Economy

In comparing motor vehicles with horse traction a point which should not be overlooked is the relative cost of housing accommodation. In stables, in addition to the space required for

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the horses, and also the covered accommodation for carts, a large proportion of building is required for storage of fodder and for the preparation of food, harness, etc. The total space required for motors only amounts to about 50 per cent of that required for horses, while the class of building may also be of much less expensive character.

Light Municipal Vehicles

The Liverpool Corporation has in use at the present time eleven vehicles of the heavy type. It has also ten light vehicles which are used by officials and members of committees in connection with the works of the municipality. The experience gained with these latter vehicles may be of some assistance to members

Wheel With Compressed and Impregnated Paper Tread.

of the association who may be considering the use of such vehicles in connection with their duties, or who may have work for light gasoline vehicles.

Having had a training as a mechanical engineer, the author at first, perhaps naturally, favored the vehicle propelled by steam. His experience with some of the early types of steam vehicle, however, forced him to the conclusion that the advantages of the steam engine—its elasticity and smoothness—were more than counterbalanced by the difficulty in obtaining a satisfactory supply of water, and of maintaining the very light type of verticle fire tube boiler then in use, and that these disadvantages would, at any rate for the time, be sufficient to severely handicap any light steam vehicles intended for use over considerable distances.

Attention was, therefore, directed to the gasoline explosive engine, and in 1901 the author acquired one of the earliest motorbicycles, covering during the summer some 7,000 miles. Where cheapness in first cost and subsequent maintenance is a matter of necessity, while at the same time considerable distances have to be covered, the motorcycle may with advantage take the place of the ordinary cycle for the younger and more active members.

Cost of Operating Motor Tricycle

For many purposes of the surveyor, however, the three-wheeled vehicle is superior, and especially is this the case during the winter months and wet weather, when greasy roads may have to be negotiated at nights. A very suitable form is the motorbicycle, which, in bad weather, can be readily converted into a tricycle or fore-car. The cost of running such a vehicle (which does not require a driver), should, on an average of 6,000 miles per annum, work out approximately as follows:

Total cost, $288. Life, say 3 years, $96	1.6c
Tires	4c
Gasoline and stores	4c
Repairs	4c
Licenses, etc.	2c
Total cost	3.0c

Cost per mile taken on 6,000—3c per mile.

The two-seated car comes next in the order of size, and will be found to very satisfactorily meet most of the requirements of a surveyor.

Where greater seating accommodation is occasionally required, this is best supplied by having the back or tonneau portion removable, or by separate hiring of a larger vehicle according to the requirements of the case, and it should not be forgotten that working costs, and particularly the cost of tires, are considerably increased by the carrying about of any unnecessary weight.

With regard to the number of cylinders recommended for such a car, the author considers that a single or two-cylinder car of 8 hp. to 10 hp. meets all requirements for a two or occasional four-seated car, but if a four-cylinder car is preferred, it can now be obtained from several makers at a reasonable cost. It appears, however, doubtful whether, for purposes of hard work, the additional smoothness in running is not more than counter-balanced by the additional complication, especially where a trained driver is not kept.

Cost of Operating a Small Car

The cost of running such a car, taken on a basas of 8,000 miles per annum, should work out on the average as follows:

First cost, including spares, hood and screen, $960.	
Life, say, four years, $240	3.0c
Tires	2.40c
Gasoline, stores and ignition	1.28c
Repairs	1.28c
Insurance and licenses	54c
Driver, if required	3.74c
Total cost	12.24c

Cost per mile taken on 8,000 miles—12.24c per mile.

Cost of Operating a Large Car

When a larger car is required it is seldom necessary to exceed 16 hp. to 18 hp. A six-seated car is found useful by sub-committees for inspection purposes.

The cost of running such a car should, on the average, work out as follows:

First cost, including spares, hood, or top and screen, $2400.	
Proportion of life, say, five years	6.0c
Tires	3.0c
Gasoline, oil, and stores	1.6c
Repairs	1.6c
Insurance and licenses	6c
Driver	4.0c
Total cost	16.08c

Cost per mile taken on 8,000 miles per annum—16.8c per mile.

(To be continued.)

Rigid Wheel With Cast Center and Spokes.

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Their Attention

WITHOUT leaving his seat the driver can do much to ameliorate misfiring in an engine. Switching to the second set of batteries will often restore a "dead" cylinder to life, the current in the other set probably being inadequate, or the sparking plug points or the coil tremblers being imperfectly adjusted. Rocking the spark advance lever sharply from end to end of its quadrant will frequently cure misfiring. When the carbureter is giving trouble manipulate the levers. As misfiring or weak firing occurs, the effect of more or less air should be tried. If more air rights the trouble it will be known that flooding is taking place, or that the jet cone is unscrewed. If less air creates better running, the trouble is due to a partially choked supply pipe or jet. If the jet is choked, sometimes the obstruction can be cleared by shutting off the extra air, opening the throttle wide, and racing the engine. This may draw the obstruction from the jet, especially if it is water, when the engine will run properly again.

Minimum Gasoline Feed

After a driver has become accustomed to the operation of his wagon he should not fail to gradually cut down the gasoline feed until the point is found at which the motor runs well, but will not stand further reduction. The smaller the proportion of gasoline the more economically the motor will run and the cleaner it will keep. This can, of course, be carried to extremes and the efficiency of the engine interfered with; but the proper feed can be determined without great difficulty. The same process should be applied also to the cylinder lubrication. When the gasoline and lubrication oil are feeding into the cylinder in the smallest quantities that will produce good results the motor should run for a long time without fouling the sparking plug and on the minimum amount of oil.

Corroded Battery Terminals

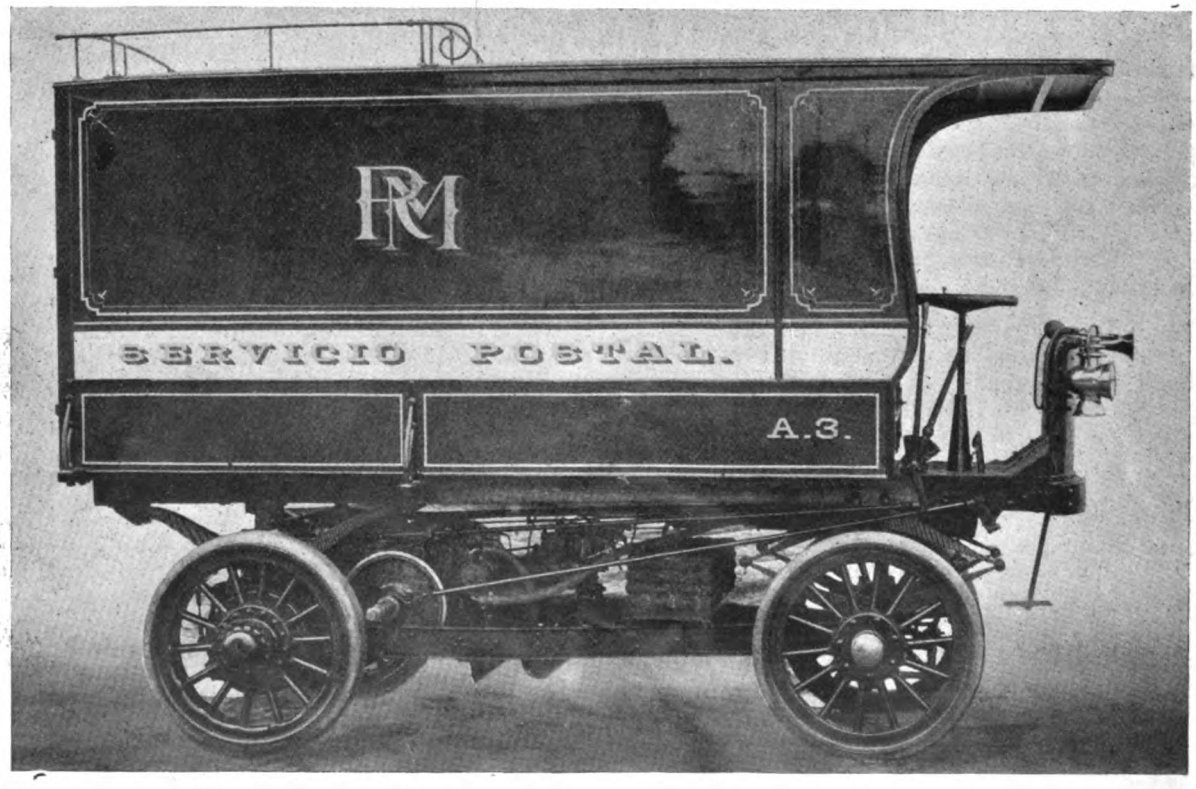
Creeping of the sulphuric acid in an accumulator will sometimes so corrode the terminals that it is almost impossible to remove the terminal nut. A few drops of kerosene allowed to soak into the thread will often loosen the nut, but if this method fails two small pincers or pliers will be necessary, one to hold the terminal, while the other grips and turns the nut. If the terminal is not so held it will be ripped away from its connection. It is an excellent plan to smear vaseline over the terminals occasionally. This will protect them from the action of the acid.

Lubrication

If the lubricator used to feed well, but becomes worse as time goes on, there is another thing to be looked for, and that is oil which for some unexplained reason has found its way into the oil pipe that connects the lubricator to the large exhaust pipe, and has become *crusted.*

Exhausted Dry Batteries

Dry batteries can sometimes be induced to give a few more sparks, when apparently exhausted, by soaking them for fifteen or twenty minutes in hot water, allowing the water to pass through holes punched in the layer of asphaltum at the top.



Three-Ton "Atlas" Truck sold to Post Office Department of Mexican Government.

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MOTOR TRUCKS IN MINNESOTA

SINCE the advent of the motor truck in Minnesota these useful vehicles have developed great popularity and are now being recognized as a coming great factor in the state for commercial uses.

The first large truck was introduced by one of the large furniture firms, and it did not take long to show those watching the experiments that the vehicle in question had come to stay. One of the next firms to take up these auto delivery wagons was the Pillsbury-Washburn Flour Mill company. The company secured some five-ton covered electric trucks that proved very popular, not only because of their efficiency in all kinds of weather, but because they could handle great quantities of flour with each load.

The gasoline trucks, however, have proved popular, and each day sees the advent of some new machine. There are now nearly 150 trucks of various kinds in Minneapolis, and the number is still growing.

In St. Paul the trucks are proving very popular. The Smith Candy company instituted the first truck of this kind and it became so well known that it did a great deal towards advertising the firm and increasing its business. Trucks of the large variety soon followed and now there are very few of the numerous wholesale firms that do not own at least one.

Another stronghold for the self-propelled vehicle in Minnesota is Duluth. Although some of the hills in that city are almost unnegotiable, these heavy carriers have found great favor among many of the firms. They are especially liked by the firms and associations who handle a great amount of business across the great lakes. The trucks have proved very useful in carrying freight down to the water front and depositing their cargoes.

The outlook for the motor trucks in all of the cities of the state is very bright and in almost all of the smaller cities, where there is nearly always a brewery or mill, the representation of the future commercial carriers is very well marked.—*Minneapolis Tribune.*

Information For Buyers

Apple Ignition System

THE question of ignition is a very important one with any gasoline power vehicle, but it is especially so with commercial power wagons. The Apple ignition system consists principally of a storage battery from which the current is drawn. This battery is kept charged and in good condition by means of a small dynamo. The dynamo runs by friction contact with the fly-wheel of the engine, generates sufficient current, and delivers it to the storage battery, so that there is always plenty of current available, not only for ignition purposes, but also for electric bells, lights, and other subsidiary purposes as desired. By having two reliable sources of current always at command there is practically no way in which a driver can be left in the lurch through lack of "juice" for ignition work.

The Apple system as installed also includes an automatic cut-off, so that when the engine is not running the battery current is cut off and it cannot run back through the dynamo and short circuit the battery, as it otherwise would. The system is also fitted with all necessary meters, timers and plugs, and, completed, furnishes a very reliable and efficient bulwark against the ignition troubles so commonly met with. It must also be remembered that the power and speed of the vehicle depends very largely on the spark, and it is one of the claims made for the Apple system that it increases the earning powen of the vehicle on which it is installed by keeping its engine working at a maximum of efficiency. It may also be noted that the Apple dynamo, while small, is nevertheless claimed by its makers to be unsurpassed in construction and efficiency by any dynamo made, regardless of size or use for which it is intended. It is being taken up by some of the strongest concerns in the country, and wherever tried gives complete satisfaction. It is manufactured by the Dayton Electrical Mfg. Co., Dayton, Ohio, who have centralized their entire plant on the making of ignition apparatus, and are therefore entitled to be rated as first-class authorities on the subject.

Two-and-One-Half-Ton, 30 hp. Logan Wagon Shipped to Mexico.

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BUYERS OF "RAPID" WAGONS.—Sales of power wagons were recently made to the following concerns by the Rapid Motor Vehicle Co., Pontiac, Mich.: Peter Smith & Sons, Detroit, two machines; C. M. Rodgers, Buffalo; New England Telephone Co., Boston, four machines; W. Carey Smith, Mt. Vernon, N. Y., duplicate order; Deright Auto Co., Omaha, duplicate order; Stix, Baer & Fuller Dry Goods Co., St. Louis; Butler Motor Car Co., Boston, five machines; Kaufman Bros., Pittsburg; National Lead Co., Chicago; D. O. Eaton, Philadelphia, duplicate order; Brocton Auto Exchange, Brocton, Mass., duplicate order; J. W. Ransley & Son, E. Orange, N. J., duplicate order; Allen Motor Car Co., Portland, Me.; Wisconsin Auto Transit Co., Manitowoc, Wis.; Jos. Maw & Co., Winnepeg, Man.; J. W. Crouse, Raton, New Mexico; B. J. Robinson, Vicksburg, Miss.; E. J. Walker, Marinette, Wis.; Union Transportation Co., Austin, Tex.; American Sight Seeing Car & Coach Co., N. Y. City, three machines 25-passenger; A. A. Deimel, Detroit, two machines 25-passenger.

SOME RECENT SALES.—Within the past few days the Kansas City Motor Car Co., of Kansas City, Mo., has sold vehicles to the following concerns: to Abbot-Miller, Quincy & Boston Express, Quincy, Mass., a two ton wagon; to Reynolds & Hill, Coffeyville, Kan., a 35 passenger bus; to W. K. Morrison, Minneapolis, a two ton wagon.

COMPANY OFFICERS ELECTED.—Organization of the Williams Motor Car Co., of Akron, Ohio, has been effected by the election of the following officers:

President J. F. Townsend; vice president and general manager, H. A. Williams; treasurer, Henry Robinson; secretary, L. D. Slusser. This company, which was incorporated not long ago with $5,000,000 capital stock under the laws of South Dakota, expects to begin manufacture on a large scale as soon as possible. G. Frank Fries, Buffalo, has been engaged as superintendent of manufacture. Present plans include the erection of a plant 250 feet square. The company hopes to begin work on the new plant in 60 days, and it is desired to start the plant by December 1. Plans are being made to build 25 styles of commercial cars, ranging in price from $1,500 to $10,000, and in weight up to a 20-ton truck.

COMPANY VACANCIES FILLED.—At a recent meeting of the directors of the Logan Construction Company Charles F. Smith, treasurer, was elected secretary. B. W. Twyman, sales manager, was elected to fill the vacancy on the directorate caused by the death of Mr. W. H. Hunter.

SALVAGE CORPS WAGON.—The electric vehicle which the Studebaker Company sold to the Cincinnati Salvage Corps is giving such satisfaction that the fire department of the same city is importuning the authorities for the supply of one or more motor vehicles.

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ADVERTISING RATES ON APPLICATION

WALTER WARDROP, EDITOR AND PUBLISHER

Service Efficiency

Administrative Ability the Deciding Factor in the Operation and Care of Motor Wagons

DECIDEDLY the most interesting problem for an establishment which has purchased a number of power wagons, or contemplates doing so, is the effort to maintain the stable and road service at such high efficiency that the maximum of vehicles will constantly be advantageously employed.

Recently some highly interesting developments have come to light which amply confirm the belief so often registered in this paper, namely, that whenever motor wagons are reasonably well adapted to the service in which they are employed their failure or success is wholly ascribable to the lack or existence of administrative ability among the people directly responsible for their purchase.

We use the word failure in a limited sense,, for as a matter of fact no power wagon of orthodox construction, which is suitably employed and well cared for, has yet failed of success from the economic point of view, particularly if its cost of maintenance and operation is contrasted with that of horse-drawn vehicles in the same service.

A year ago the executives of one of the biggest breweries in the middle west loudly complained that they were unable to keep more than 60 per cent. of their vehicles on the road. Today this establishment is obtaining 95 per cent. efficiency out of these same vehicles. This astonishing improvement is all the more surprising when one reflects upon the looseness, even extravagance, with which the merchandise road transportation of breweries, almost without exception throughout the country, is conducted. Apparently the house in question has awakened to the fact that the efficiency of motor wagons being given, it by no means follows that this efficiency can be continuously obtained without close study of all the conditions which surround the service.

Upon finding that their vehicles were not performing work in the manner expected they wisely conciuded that the fault lay not in the vehicles themselves so much as in the stable attention which they received. After reaching this decision it was decided to make a change in the stable administration. The work thereupon was turned over to a highly competent manager who laid no claim to any great gifts as an engineer, scientist or electro-chemist, but who certainly did have an abundance of common sense and persisted in regarding the vehicles as machines which could and should be kept in as thorough a condition of repair as was compatible with service, The machines under his control, which happened to be of the electric type, soon began to show noticeable improvement in their daily performances, and before long sick and ailing vehicles were as scarce as formerly they were plenty. Naturally this change was not brought about in a day; in fact it took almost six months to demonstrate that the normal condition for a power wagon was one of healthy activity and not of ailing inactivity.

Strangely enough, another large brewing company in the east simultaneously reached the same point of development in the use of its electric vehicles. This establishment also a year ago had failed to comprehend the responsibility which purchasers of power wagons assume when the vehicles are put in service, and naturally the showing was far from brilliant. Like the middle western concern, however, it soon realized that

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permanent efficiency of vehicles was the grand object to be aimed at in their employment, and as soon as this idea took root the superior economy of the vehicles was developed as part of the general administrative work of the establishment.

Not long since the statement was made by the operating engineer of one of the large motor bus companies in London that despite the extreme difficulties of such service he was able to maintain 95 per cent. of the vehicles under his control in useful work on the road. Such a statement is all the more remarkable since the vehicles at that time had traveled a distance of over 500,000 miles. To comprehend what this really means it is necessary to remember that the average weight of a London bus is five tons without passenger load, and seven tons with it; that the vehicles are operated on an average of about 14 hours a day with a double shift of men; that they travel between 12 and 15 miles per hour; that, in short, motor bus service is of the high pressure variety which is calculated to most severely strain all working and wearing parts.

The personnel and equipment of a motor omnibus garage is complete in every detail. In previous numbers of this paper the nature of the shop equipment and the functions of the operating company's service have been described, and it has incontrovertibly been shown that the whole business of motor bus operation is solely regarded as a problem in maintenance.

In an attempt to strike an average efficiency for motor buses an authority, allowing for the varying conditions of management and service, makes this declaration:

"Eighty per cent. of the total possible bus trips is good working. The number of omnibuses allotted to each route should be multiplied by the number of journeys, which calculation yields the aggregate of vehicle-trips, and, if less than twenty per cent. has been lost, the proprietors may congratulate themselves. There must be no further allowance for spare machines, where this basis of test is taken; every chassis which has actually been once put in service must be reckoned, and the 'lost journeys' reported on the daily log-sheets of machines which are out must be swelled by the necessary additions of 'number of chassis in depot' x 'journeys for the allotted route.' In cases where no account is taken of lost journeys on the road, and every motorbus is considered effective, provided it is used during some part of the day, we should regard 90 per cent. 'out' as requisite to equal 80 per cent. on the more detailed system of record-keeping.

"A company which finds itself consistently with less than 70 per cent. of the possible bus-trips to the credit of its running department is in an unhappy position. The inevitable consequece may not yet have made itself felt; but such companies will not survive competition when the day of motor versus motor comes round, though a less degree of efficiency than seventy per cent. may suffice for a time. So long as the mechanical vehicle has the advantage of choice amid an excessive patronage, and so long as a large share of its custom is secured at the expense of horsed omnibuses, sickly undertakings will earn meager dividends. That day of grace, be it noted, is passing away, and the favoring circumstances we have quoted will be non-existent but little more than two years hence. There is no more than that interval for the acquirement of experience."

Administrative ability is variously interpreted that is to say, the efficiency of an organization is high or low according as the experience or wisdom of the chief executives is great or small. Probably the highest order of executive ability in the operation of power wagons would be that which, accepting the assurance of automobile engineers that all kinds of power wagons, freaks alone barred, are designed to be operated with profit, perceives that it is a plain duty to obtain that profit.

Insistence upon good stable care should be the first concern of an executive who has purchased power wagons. The choice of an administrative stableman, therefore, is among concerns employing large numbers of vehicles, or using them for the transportation of large tonnage of merchandise, a matter of the very highest importance. It is not easy to procure such men. Most of them have developed themselves, but the development has been accomplished at the suggestion or wish of the chief executive of the concern by which they are employed.

The careless selection of stable foremen, indifference to or neglect of any of the problems involved by the employment of power wagons will inevitably lead to low service efficiency; on the other hand, if the machines are given the scrupulous attention which they manifestly demand, their work will abundantly reward owners who are wise enough to recognize that efficiency is in exact proportion to the care bestowed upon them.

While the wasteful horse preponderates, concerns employing power wagons can safely indulge themselves with liberties in the operation of their machines. The time is fast approaching, however, when administrative methods alone will develop the economy of the power wagon. That day, as has already been remarked, will arrive when motor wagons compete with motor wagons and not with inferior horses. Administrative ability will be the sole deciding factor in the competitive use of power wagons then as in reality it is now.

TO TEST ALCOHOL AS FUEL

As going to show how far popular fancy has outrun commercial performance in the matter of making use of alcohol as a fuel for internal combustion engines, it may be remarked that Prof. Charles E. Lucke, of Columbia University, is just about to undertake, on behalf of the government, an investigation which will do much to clear up prevailing differences in opinion concerning the worth of the spirit for the purpose mentioned.

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Functions of the Driver

Duties of Driver Must Necessarily Vary With the Extent of the Power Wagon Installation

OPINIONS differ widely concerning the duties which should be exercised by power wagon drivers. Some constructors of the machines, accustomed to observe the effects of faulty operations, believe that eventually the functions of drivers will be confined exclusively to the manipulation of levers, brakes and steering apparatus, leaving to experts in the stable the more difficult and more important duty of caring for the machines. It has even been declared that the power wagon driver of the near future will have no mechanical skill whatever, the machinery being locked up and sealed so that he cannot tamper with it either out of curiosity or in emergency.

It it hardly necessary to poin out that aspirations of this character can only be gratified in establishments which employ a considerable number of machines. It is equally plain that concerns which operate but one or two machines, and which are consequently unable to afford the expensive stable administration of a large concern, must now and in the future rely almost exclusively upon their drivers to effect such adjustments and minor repairs as may become necessary, unless the mechanical upkeep of the vehicles is turned over to professionals who live out of such work. Probably in a choice between the high cost of outside professional assistance and the low cost of having the machines looked after by drivers, the majority of concerns using few machines would prefer to have all of the work done by their own employees, even at some slight sacrifice of quality in the work.

Attention has already been drawn in this paper to the method by which the service efficiency of large motor bus companies is maintained. The location of road inspectors on all routes, whose particular duty it is to render aid to the drivers of vehicles which are in trouble, would be too expensive a plan for the merchant to copy. The method of the express companies, and other concerns operating large numbers of motor vehicles, of placing entire reliance upon the stable inspection of machines before they are permitted to go on the road, is much more appealing, particularly where spare machines are held in reserve to supplement the work of service vehicles.

Concerns which have only casually considered the substitution of power wagons for draft animals do not quite appreciate the necessity for having spare machines. This is not due to unfamiliarity with the thought of spares, for it is rare to find a large horsed transportation service which does not make the most liberal calculation for interruption of service from disease and overwork of its horses. And the greater the pressure of service, the more liberal the allowance. Some of the operators of high pressure motor bus services in London believe 20 per cent of the total vehicles employed should be held in reserve as spares. In spite of this the services are made to pay. This percentage would be heavily reduced, however, if the machines were given less arduous work. The number of spares is invariably in proportion to the severity of the service.

The whole problem of power wagon maintenance must eventually be solved by owners. While this belief is prevalent it is not easy to describe the means by which the desired end is to be attained. The germ of reform, however, undeniably lies in co-operation among owners. Today every establishment is developing its own administrative stable methods, due no doubt to the fact that at this moment administrative skill is a monopoly worth having. As time goes on, however, it will become apparent that merchants of various classes employing power wagons of similar types can easily afford to combine for the stabling and maintenance of their machines. The co-operative garage idea is not new, in fact it has already been profitably exploited by professionals both in this country and abroad. Its ripe fruit, however, will not be plucked until merchants appreciate the economy of the system.

In Chicago and New York merchants long ago combined to reduce expenses in the operation of draft animal service, and many of these co-operative organizations are considering the extension of the system to the power wagons which they confidently expect to purchase before the close of the year.

Happily at this moment it is not of extreme importance that the maximum of economy in the operation of power wagons should be attained. Even with loose methods which prevail money is being systematically saved by the substitution of motor vehicles for draft animals. It is not pleasant, however, to contemplate a perpetuation of these loose methods. Chance carelessness today but too frequently becomes the fixed habit of tomorrow. It should, therefore, be the study and desire of every power wagon user to make the most of the opportunities which employment of the vehicles presents.

The function of the driver of necessity varies with the extent of the power wagon installation. It is, therefore, obviously impossible to define the specific character of his duties and say whether they shall be narrow or large, automatic or otherwise. It is absurd to imagine that a small grocery store can be operated by the methods which are suitable for a large corporate enterprise. In short, the driver problem is an individual study.

By the time the novelty of transporting city merchandise by motor wagons has given way to close scrutiny of its details it is not improbable that the qualifications for rank among drivers will be of a far different order than now distinguishes such labor. That this time is approaching with more rapidity than the casual observer would suspect may be inferred from the fact that in not a few well governed establishments, where power wagons are employed, the chief concern of the administrative stablemen is not the behavior of the vehicles on the road, but the number of packages or volume of merchandise each driver

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(not each wagon) can deliver at destination in a single day. In these highly organized institutions the wages of drivers is exclusively determined by ability to keep the wagons profitably active.

Idle wagons compel a more extensive investment for equipment than would be necessary if full advantage was taken of their capacity. Only the artist in transportation matters seizes the opportunity thus presented. He recognizes in it the chief element in the science of merchandise delivery by motor vehicles.

MUNICIPAL REFUSE WAGONS

ANOTHER city official who believes in the economy of municipal power wagons is Street Superintendent Neare of Cincinnati. He favors the use of motor trucks for hauling refuse to the dumping stations.

It appears that the city railway company wants to charge 25 cents per car mile for this service, a figure which the street commissioner deems exhorbitant. He rightly believes the work can be accomplished much more economically by eight motor wagons costing $5,000 apiece, which sum, by the way, is the same as would be required to purchase refuse cars for operation on rails.

The mayor questions the legality of entering into a contract with the traction company for hauling the refuse to and from the dumping stations, and says he may veto the ordinance authorizing $145,000 bond issue for the establishing of the dumping stations on that account. The city apparently has the choice of laying its own tracks, operating its own rail refuse wagons, or avoiding much of the expense this implies by removing refuse with municipally owned motor wagons.

To clean the streets of Cincinnati next year will cost $288,000; to haul its ashes will cost $136,000. It remains to be seen if the municipality will emulate the example so conspicuously set by its merchants and employ the power wagon in work for which it is peculiarly well adapted, as has been amply shown in previous issues of this paper.

Senor Arturo Vickers expects to establish a motor bus line in Bahia Blanca, Argentina.

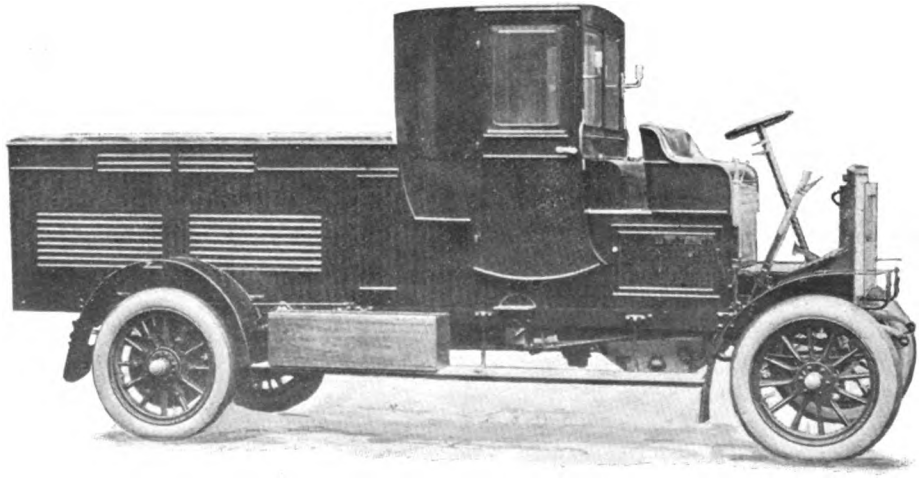
AN EXAMPLE OF FAITH

THE Oneida Milling Co., of Utica, N. Y., has just put into commission a 3-ton electric truck equipped with steel tires. The duties of the machine will be light. It will be expected to make ten or twelve trips per day between the factory and the freight house, about three-fourths of a mile away, going with cases of knit goods and returning empty. It replaces three two-horse trucks and enables the company to dispose of six horses, two trucks and the services of two drivers and a barn man. The truck will be charged by a special reduction equipment taking current from the company's own plant.

The company seems to have gone at this matter in just about the right way. It is reasonable to assume that the same management which has effected a 15 per cent saving in general operating expenses in the last three years will effect an even greater reduction in their trucking expense. Realizing that others have made an economy by the use of motor trucks which have been called to a harder service, the Oneida company has ripped out its entire horse outfit and has put the motor truck on its own merits.

The surest and quickest way to make a power wagon service pay is to rely exclusively upon it.

An ordinance authorizing the purchase of an automobile at a cost not to exceed $3,500 for use by the police department was introduced at a recent meeting of the Los Angeles, Cal., council. The city's fire chief has also asked for the appropriation of $1,500 for the purchase of a machine.



Motor Hearse

THIS vehicle has been in service in Paris for upwards of a year. It is operated by a 24 h. p. gasoline engine. Its utility has already accustomed people to overlook the audacity which inspired its construction. Low tension magneto ignition is provided. The machine has three speeds, 35, 22 and 12 kilometers an hour. The frame is armored wood.

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Military Motor Transport

Army Authorities Surprised at High Charge Asked for Power Wagon Demonstration

SURPRISE has been expressed that power wagon manufacturers should have taken so little interest in the official invitation to supply vehicles to accompany the troops in the course of their recent maneuvers. The one concern which languidly offered to place a two-ton truck at the disposal of the quarter-master general demanded payment for the service at the rate of $92.50 a day, which for the ten days of the maneuvers would amount to $925. A contemporary considers the charge exorbitant. We don't.

The point of view is everything in the consideration of an important matter. The quarter-master general calculated that he could obain mules to pull the same loads as a motor truck at a cost of $7 a day.

If mules were not so pervasive, if, for example, they were to be found only in the state of Missouri, it is impossible to believe that they could be hired for work in the east at any such price. If the brutes were as scarce as power wagons, it is highly probable that their service would command the same premium as the the machine's. This is the point of view which apparently wholly escaped the quarter-master general.

This was the actual situation: The quarter-master general desired demonstrations of the serviceability of military motor trucks. He was even willing to pay for them—upon terms of his own choice, namely, mileage traversed. But, unfortunately, he selected as the theater for action spots so remote from the center of the power wagon industry that it became impossible for manufacturers to comply with his wishes without incurring heavy expense in sending vehicles and demonstrators a long journey by rail and disappointing more promising customers in civil life. The maneuvers were conducted simultaneously in various parts of the country. Surely it was extreme ignorance of prevailing conditions which led the quarter-master general to expect that a power wagon could accompany the troops to Portland, Oregon, upon two weeks notice or at a cost of $7 a day.

Let us assume that a motor-wagon maker, willing to oblige the quarter-master general, had at the time that official issued his invitation a score or more deferred appointments with commercial houses to demonstrate a particular machine which was suitable for military service. The facts of trade do not belie the assumption. Would it have been reasonable to expect that these prospects should be sacrificed merely for the purpose of demonstrating that pacific military transport work presents no more difficulties for a power wagon than the bulk of commercial service?

Hardly.

Ten dollars a day is a very modest charge for a local demonstration of a power wagon, with demonstration machines as scarce as radium. It is dirt cheap for a distant demonstration. If the wagon had to be freighted from, let us say, Chicago to New York and return, or between points equally distant, a bill for $100 would have to be met by the manufacturer, not to mention the loss represented in time while the vehicle was in transport. If the machine was shipped by express, the manufacturer would be out $400 or so, depending upon the weight of the vehicle and a calculated charge of $2.50 per hundred pounds for an eastern journey of a thousand miles with correspondingly higher charges if the shipment was through the western country. The service of a demonstrator is worth $2.50 a day at the lowest computation. If he had to go a long journey to distant army maneuvers he might be absent for two weeks or more at a cost, including railroad fare and living expenses, of from $80 to $150 to his employer.

Very likely the quarter-master general overlooked these unimportant matters. Doubtless he considered that all obligations would be cancelled by the payment of six or eight cents a ton mile, mule service being available in every hole and corner of the country at about that price. Doubtless, also, he harbored the illusion that manufacturers can spare machines for demonstration purposes as easily as his cocky aides can spare words for decoying manufacturers.

For the information of all who, like the quarter-master general, do not understand why power wagon makers are reluctant to make demonstrations, be it said that if the sum of $100,000 was by any one concern invested in demonstrating machines it would yet be found insufficient to appease the demand.

Officers in the quarter-master general's department, smarting under the apparent affront put upon them by the makers of power wagons, testily declare that manufacturers are more eager to sell machines than to rent them. This is a very narrow view of the matter. If the Washington bureau officers would authorize for military motor transport experiments the expenditure of a fraction of the money which is annually wasted on the proving grounds, the chances would be strongly in favor of the rapid development of a type of vehicle which could be regarded as a permanent feature of army equipment.

The power wagon is no freak—no experiment.

In these piping times of peace the army authorities can afford to be leisurely in their contemplation of the usefulness of the power wagon. Put in a difficult situation, however, when military operations were something more than sport, it is quite likely that the quarter-master general might have occasion to regret the dependence placed upon the toiling mule whose labor can be procured so readily and so cheaply.

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Administrative Capability

Excellence of the Power Wagon Delivery System of a Large New York Concern

A LIGHT electric delivery wagon bowls easily along one of New York's up-town thoroughfares, guided with wonderful precision amid the dense traffic, now passing a plodding horse delivery wagon, now overtaking a procession of cabs, only to be held at some busy cross street by the signal of a policeman. At the sound of his whistle it again resumes its ten-mile per hour speed and eventually comes to a stop. A man in uniform gets down with a parcel, delivers it, obtains an acknowledgment of its delivery, exchanges a word with the motorman, who shoves forward the control lever, and the machine is off again on its time-saving journey. Every second counts, for the wagon is on a regular delivery which is run per schedule. The vehicle is "No 8" of the Gorham company's delivery service.

In the company's garage on 36th street, the manager, Mr. L. Demmert, can at any time tell where "No. 8" is, when it will be back, how much current it will have when it gets back and, therefore, how much further it will run before recharging. He can tell all this, provided the wagon is properly handled, and if it isn't—but that is another story.

The delivery system of the Gorham company, silversmiths of New York City, is one of the most interesting installations of power wagons among that class which has to meet a little more than average conditions of both light and heavy work. Despite the fact that the company's patronage comes from all parts of Greater New York, from New Jersey, Long Island and Harlem —its deliveries have been made economically and satisfactorily by electric vehicles since the spring of 1899. Not a horse to a Gorham vehicle in seven years! Inasmuch as this service has proven to be exceptionally efficient, it is well to note just what factors have entered into its success.

The management seemed to realize at the outset that the location of the garage plays an important part in the efficiency of the service. Since the Gorham retail store was centrally located, it was only in accord with fortunate circumstances that the garage could at once be central, near the store, and out of the high rent district. But establishing the garage in the company's factory was a commendable and far-sighted arrangement. The factory lower floor could hardly be put to a more economical use. The retail store is at the intersection of Fifth avenue with 36th street, while the factory is near Seventh avenue, only two or three minutes away.

The ground floor of the factory is 35 feet by 90 feet, which is sufficient room to accommodate the wagons, a machine and tool shop at the rear end, a locker room, and a twelve section rheostat charging board. The garage floor is cement, graded slightly toward the center, where are two sewer grates, located about twenty feet from either end, over which the vehicles are washed.

At the rear, under a grand skylight, and occupying a ten-foot space the entire width of the room, is a machine shop having a drill press and lathes operated by an electric motor. The machine and tool equipment is such as to enable the company to make all its own repairs. A great saving has in this way been effected. It has been necessary to replace several axles, driving pinions and motor parts, and to make several minor improvements in the wagons from time to time. This work, together with battery attention and replacements, requires the services of a machinist, battery-man and two helpers who also do the garage work.

It would seem that the same care which is found in one department permeates the whole institution. In a delivery service, truly, time is money, and judging from the Gorham establishment one would think that seconds measure dollars. Extra sets of wheels are kept on the garage floor for use in such emergencies as cut tires, smashed wheels from skidding into curbings. Such accidents are rare, but if no provision were made to meet them immediately a simple accident might lay the wagon up for hours.

Extra parts, such as steering gears, motor bushings, driving pinions, axles, tires, battery plates, in fact all parts subject to wear, and patterns of other parts, are always in stock. In the course of a season the saving of time resulting from this provision, magnified by the aggregate of the vehicles, mounts into a tidy sum. Economy of this kind is the best indication of administrative ability in the operation of power wagons.

The current for charging the batteries is taken direct from the New York Edison company's wires, and is handled through Westinghouse automatic cut off

Gorham Light Delivery Wagon; 44 Cells; Spur Gear Drive.

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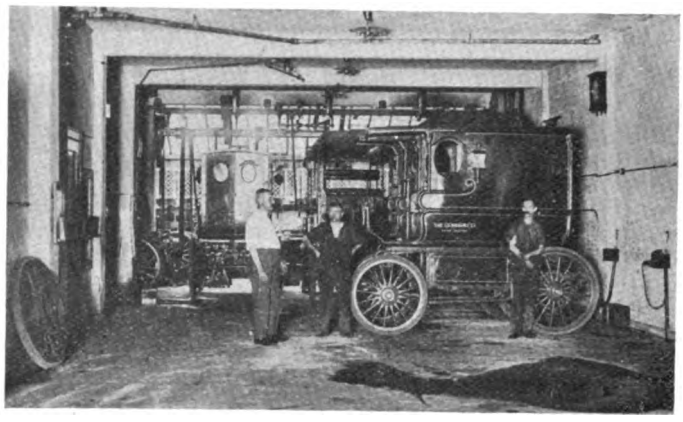
rheostats provided with twelve leads to the garage right hand side wall, where a dozen vehicles may be charged simultaneously. The battery equipment is uniform in capacity for all the vehicles, but differs in types.

The vehicles of the Gorham service are particularly adapted to the demands made upon them. They are graded as to weight, capacity, range of speed and rate of speed. The equipment comprises in all 15 wagons. One two-ton truck is in service day in and day out between the docks, where it receives shipments of goods from the company's Providence factory, and the store or warehouse. Two one-ton trucks are in constant daily service between the Fifth avenue store and the 36th street factory or the warehouse. Nine light delivery wagons are under a rigid schedule on uptown and downtown parcel deliveries, forenoon and afternoon, so that they average uniformly 30 miles each per day during the busy season between October and July. Aside from the above, there are two four-passenger surreys for the accommodation of visiting buyers, and a light runabout.

The entire establishment is under the supervision of the manager. There is maintained a rigid and frequent inspection of all the vehicles, and with the system of charging and caretaking it is no wonder that all of the units are at all times ready to meet the most exacting service.

A record of the work of the wagons is kept which considers one wagon as a unit, and not as a part of the whole system. A check is thus had upon the motorman and deliveryman as well as upon the actual efficiency of the machine. Each vehicle has a book, numbered corresponding to its own number, wherein is entered every item of the care, operation and repair. These books are kept by the manager, and from them, with their records of odometer mileage, weight of loads, and number of packages delivered, can be determined the exact cost per ton-mile, per vehicle mile, or per hundred

Gorham Feeder Truck; 44 Cells; Spur Gear Drive.



One-Half of Gorham Garage.

parcels, or any other variation of computation that may be desired over any period.

In the delivery of goods the Gorham company, on account of its class of trade; the frequent stops, long hauls and great value of parcels carried, provides each wagon with two men—a motorman and a deliveryman. The deliveryman is also a motorman, so that in cases of emergency, like arrest, he can take the wagon to the garage without any interruption in service. This brings the total of employes up to twenty-eight.

Prior to the installation of this service the company's delivery and truck work was done under contract, so that no comparison of costs between the old and existing service can be instituted. However, with the present system working with such clock-like precision, to match it by a horse delivery would require more than 50 horses, 25 wagons and 60 men. The saving of the motor system in wages alone, figuring $15 per week as average wage, would amount to more than $20,000 per annum. Inasmuch as the transportation company with which the Gorham company formerly contracted was not in the business for health betterment, it is safe to assert that it did not take much more than a twelve-month to pay for the cost of the motor installation and equipment, especially when the other items of saving are figured into the account.

The chief factors in the great success of this service are: saving in garage location, saving in garage operation, saving in reduced repair costs, saving in time by keeping repair parts in stock, saving in battery upkeep effected by system of charging and inspection, saving in wear and tear by closely fitting the machines into the services' demands, saving of wear by eliminating causes for overloading by adaptation of vehicles to the loads. These and other less significant features of administration make the Gorham delivery service a model installation.

A motor bus line will soon be operating between Westport and Lake Placid, N. Y.

Owing to the falling off in receipts of Berlin horse drawn omnibuses—due to the introduction of the motor bus—the vehicles on one of the best routes are now being operated every four minutes instead of every two minutes.

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The New Pollution

Unwarranted Outcry Against the Emanations of the Gasoline Engine

FOR weeks past the columns of the daily press have teemed with cabled notices of the peril to the human race from the exhaust of gasoline engines in road vehicles. A titled professor of chemistry started the general apprehension by declaring that the emanations from gasoline motors is slowly but certainly poisoning the atmosphere we breathe.

"Too much carbon dioxide," he complains.

"Too many automobiles," shriek his admirers.

"Exhaust into the air is too low," growls the professor.

"Consider the discharge from high house chimneys," say his hysterical followers.

"And there's carbon monoxide also to be reckoned with," snaps the professor.

Whereupon the multitude, which has heard that a whiff of carbon monoxide will waft a soul to paradise, proceeds to curse invention and the internal combustion engine.

Of course the professor is not so incautious as to say how much carbon monoxide is given off at the exhaust of an automobile engine. He just talks large and speciously and the unthinking masses do the rest. Squeezed to fit our present purpose the thoughts of the professor on this highly exciting subpect are as follows:

"The adult on an average takes fourteen to eighteen breaths per minute, and at each inspiration inhales twenty to thirty cubic inches of air. It is of utmost importance that the air be pure. Every one knows the oppressive effect of the close atmosphere in a small room. That effect may be wholly due to the small added percentage of carbonic acid. It will not do to say that in the open air a little more or less of deleterious gas cannot make much difference. It makes all the difference in the world—all the difference between salubrity and insalubrity, between health and sickness. Another product of motor combustion is carbonic oxide, or carbon monoxide. This is a deadly gas beside which dioxide, or carbonic acid, is comparatively harmless. A small amount of this monoxide produces insensibility."

Gasoline, consisting almost entirely of carbon and hydrogen, burns with air to form carbonic acid gas and water, if combustion is perfect. It is not a fact that carbonic acid gas is a poison—rather, it is a much debated point whether it does not more likely act by taking the place of and reducing the proportion of oxygen present in the air. The close oppressive nature of crowded rooms is due to high carbonic acid contents of air in slight degree, but more so to the accompanying heat, large amount of moisture in the air, and it is supposed, toxic products given off among the products of respiration and perspiration.

To think that 150 cubic feet—the approximate total production of carbonic acid gas given off by one gallon of gasoline, measured at ordinary temperature—can, when mixed with the air along five miles of route, cause any ill effect, is absurd. Although motor exhaust gases are discharged low down, they are very hot, and rapidly mix with the air about them.

The question of carbon monoxide is much more serious; its effects in small quantities are very marked. Analyses show that, fortunately, the percentage of this gas is low, and its entire removal is a simple question of carburetter design. How easy for the learned professor to write an article which he must know implies more than facts warrant. How much better to have given a helping hand to aid people in their difficulties.

As to sulphur, the suggestion with regard to its latent possibilities, and all that these imply, would be amusing if it were not that words from such a source are not likely to be treated in a spirit of levity. Gasoline does contain sulphur. A careful chemist can easily find it, especially in the cruder samples, but its quantity is always very small. The amount of sulphur burnt daily in coal is infinitely greater than that contained in an equal weight of gasoline.

Let us take the gasoline consumption of New York at 30,000,000 gallons a year—a very exaggerated estimate. This is equal to about 100,000 tons. In one year gasoline may be burnt with a sulphur content equal to that of about one day's coal consumption. Regarded, then, as material for a scare article, the sulphur danger is quite in place; but, looked at critically, the introduction of such obstacles to a new industry, which has real difficulties enough, is to be deplored.

One feels sorry for the "eminent man of science" who, unaffected by the bacteria and excreta-laden air, is overcome by the bye products of an automobile. It is not a case of flying from evils we know, but of not caring to fly from evils to which we have become so inured by custom that they no longer seem like evils.

The foremost medical authorities do not consider the carbonic acid and carbon-monoxide emanations from a motor vehicle as in the least threatening to human life. The best-known medical journal in the world dismisses the subject with this contemptuous notice:

"The amount of carbon-monoxide emitted by an automobile must be infinitesimal compared with that which escapes from many a chimney, while in respect of carbonic acid the balance between motor buses and an equivalent number of omnibus horses must be decidely in favor of the former."

Passengers and baggage will be carried by a motor stage line which is being formed to operate between Melmore, Tiffin and Fort Seneca, Ohio. Good pike roads connect the points named.

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Motor Cab Profits

Figures Available on the Operation of Public Service Vehicles Establish Their Economy

WE are seldom permitted to inspect the operating costs or revenue returns of a motor cab company. All the more reason, therefore, why the stray information which is available concerning this highly interesting service should be given the widest publicity, especially as the use of these vehicles is being rapidly extended in the capitals and principal cities of nearly every country in the world.

Domestic experience with motor cabs has not been particularly pleasing to those who have ventured money in their operation. The service of the vehicles, however, leaves no room for criticism. Incautious purchase of horsed cab monopolies as a basis for operations, stock manipulation, and other condemned methods of commercial enterprise have in all probability been responsible for the comparatively slow development of the motor cab business in this and other countries. Without these regretable concomitants, however, it is not to be doubted that public motor cab service could have been made to pay in almost any of the principal cities here or abroad any time within the past three or four years.

That the public approves of the motor cab is evident from the increasing use of it in all cities where the vehicle is established. In New York, Paris, Berlin and scores of lesser cities the machine has had a vogue for quite a long time. Abroad, owing to the introduction of the taximeter, an instrument which automatically records the mileage traveled and fare to be paid, the vehicle is enjoying a boom. In New York the number of motor cabs is constantly being augmented, and soon will be further reinforced by a number of gasoline cabs which are now in process of test.

It is curious, but not wholly unexpected, that in every branch of commercial service in which the motor vehicle is applied, its economy is habitually demonstrated. Motor buses, motor cabs, motor wagons, motor trucks, all make money for their owners when given intelligent care and suitably adapted to service. The day of competition between motor vehicle and motor vehicle is as yet far distant. Horsed cab owners, therefore, would do well to make hay while the sun shines.

Last fall a Berlin horsed cab proprietor, perceiving the economy and popularity of public service motor vehicles, purchased six electric machines and proceeded to keep accurate record of their cost of maintenance. Two of these machines were new landaulettes, and four were of older victoria type. The total value of the investment was $10,000, including seven batteries, tools, spare parts, rheostats and other apparatus. These vehicles were worked during the most unfavorable months of the year—November, December and January—at a profit which extended for the year is equivalent to about 10 per cent interest on the capital invested.

During the period of investigation these six cabs showed 527 working days out of a total of 540. The actual costs of operation within the period mentioned were as follows:

Contract battery maintenance	$ 175.00
Tires	235.00
Repairs and new parts	50.00
Oil, polishing material, etc.,	3.00
Salaries	200.00
Taximeter rent	20.00
Electric current	187.00
Lighting	6.50
Cab depreciation at 12 per cent	233.00
Fittings and tool depreciation at 15 per cent	7.50
Office salaries	7.50
Garage rent	112.00
	$1,236.50

The receipts for the three months amounted to $1470, the balance being:

Receipts and Expenditures

Receipts	$1470.00
Expenditures	1236.50
Profit for three months	$ 233.50

The charges for current, tires, rent, battery insurance are considerably higher than would be the case if the installation was more extensive or in the care of a more experienced operator. In addition to the items mentioned there was also a charge for an obligatory pension fund.

The accounting is astray in one important particular, namely, the charge for depreciation on cabs. The most careful method of electric vehicle accounting regards the depreciation on the motor at 5 per cent and the depreciation of the remainder of the wagon at 10 per cent. If this method had been followed the showing made would have been even more favorable than indicated.

This particular cab owner has not yet discarded his horse drawn vehicles, but has progressed sufficiently in the use of electric cabs to predict that within a short time no other vehicles for light passenger service will be seen on the streets of Berlin. In making this statement he does not overlook the present popularity of gasoline motor cabs which he considers will find most profitable employment in comparatively long distance journeys.

There is some talk in Berlin of prohibiting gasoline cabs from city service, but it is quite unlikely that such an extreme measure will appeal to the authorities in control of public service vehicles.

The rural mail carriers at Waukomis, O. T., are using automobiles in their work. Two have bought machines and a third is preparing to do so. Trips that formerly took horses six hours to make are by automobile covered in two hours.

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Gasoline Fire Engine and Hose Reel at a Test Call.

Modern Fire Vehicles

Horse Drawn Apparatus Being Rapidly Superseded by Motor Driven Machines

MANY lives and much property are annually lost by the delay of only a few minutes in attacking what in their inception have been small and comparatively unimportant fires. Fire spreads with miraculous rapidity under seeming adverse conditions. The small fire may destroy a city merely for want of prompt preventive measures.

No fire officer objects to a new fighting appliance if it will assist him in the cause for which he has so much enthusiasm.

The best fire fighting appliances are those which can be most readily brought into action. Ten years ago the horse drawn steam fire engine escape or hose cart answered to this description, but not now. The times have changed rapidly since then and the march of progress in motor engineering has given us not only the motor propelled fire engine escape and hose cart, but the motor chemical first aid fire engine also.

There are many cities and towns throughout the world today employing motor fire appliances with the greatest success and economy. It is on the latter score, economy, that we shall presently speak, as however much the enthusiasm of a fire chief may prompt him to desire a fire motor vehicle his financial backers are not always imbued with a similar spirit, but, with the usual failing of inexpert human nature, are inclined to run the risks of having to regret that they had not superseded their slow horse drawn vehicle by motors before a serious fire had devastated the property under their care.

It is not unreasonable to suppose that within a few years all the great cities will have discarded horse drawn fire engines. The horsed engines will find a home in villages and towns which do not deem themselves sufficiently prosperous to invest in modern appliances. In course of time, however, the horsed steamer will disappear as completely as the village fire squirt of the Pilgrim Fathers. The general awakening of small town and village authorities to their responsibilities in the matter of fire prevention will be promoted by the supply of second-hand fire vehicles and eventually they will become disgusted with these and invest in motors.

No city which immediately contemplates providing its fire department with a motor engine, therefore, need have any doubts as to the good market awaiting the horsed vehicles to be superseded.

There is an impression in some quarters that the motor fire engine is suited only to city work. If anything

30 hp. Four-Cylinder Gasoline Fire Pump and Hose Ten der Supplied to Baron Rothschild. Capacity 300 Gallons per Minute.

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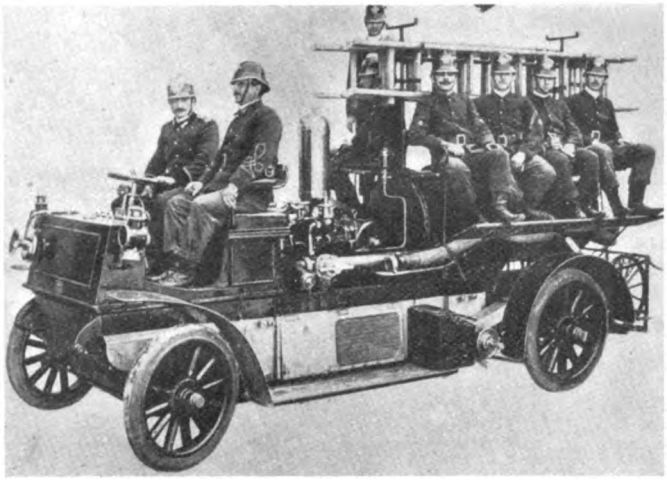
the motor is better fitted for country than city service, owing to the short distances to be traveled in the latter as against the long distances to be covered in the former.

The motor fire engine solves the difficulty of adequately protecting rural districts from the ravages of fire without putting heavy charge upon the residents of thinly populated areas. No one who has lived for any length of time in a country district can have failed to notice that the great percentage of fire calls have been to properties which were totally destroyed. Delay in arriving at the scene of the conflagration is the cause of ninety per cent of "totally destroyed" reports. And this delay may have arisen for one or all of three reasons:



Motor Fire Engine Used by Swiss Authorities.

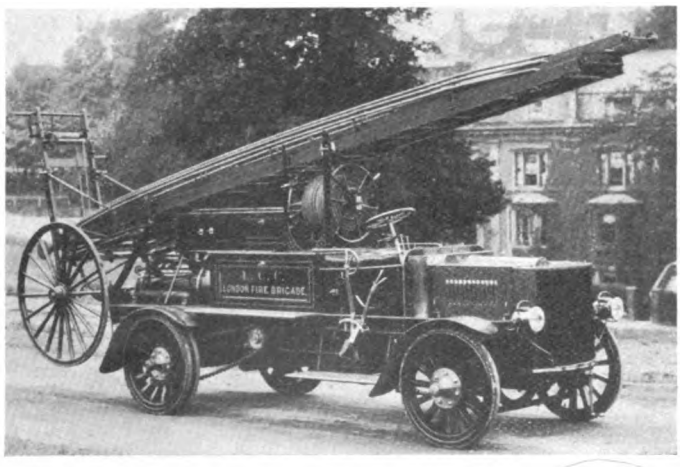
(1) Neglect to give the call on time.

(2) By the call having to be made by a messenger, owing to the absence of telegraphic or telephonic communication.

(3) By slow traveling of the fire engine to the burning property after the call has been given.

Inadequate water supply accounts for the remaining ten per cent of "totally destroyed" reports.

As to (1) the difficulty of calling the fire departments is the cause of hesitancy in asking for their assistance in subduing the outbreak. The remedy is the same as for (2), namely, the placing of every town and village in telephonic or telegraphic communication with the nearest fire department headquarters.



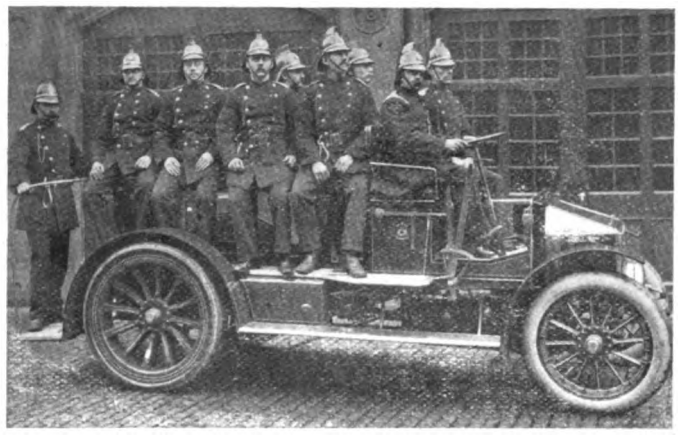
Gasoline Motor Fire Escape Used in London.

Motor Chemical Fire Engine Used in Sydney, New South Wales.

With regard to (3) it is well known that, as in provincial town and village fire brigades, no horses are owned by the brigades. Here is the greatest difficulty—obtaining horses for the fire engines quickly. Arrangements are usually entered into for the supply of horses, but at the psychological moment the horses are absent. Even when horses are obtainable they may be slow, because a pair of horses must be highly trained to travel with a fire engine at top speed.

The majority of firemen would far rather risk being injured at a dangerous fire than travel on an engine at full speed with an untrained pair of horses in the traces.

Added to the delay in getting horses, there is often the loss of valuable time in getting the units of the depart-



Gasoline Motor Hose Wagon Used in Glasgow.

ment together. This may be easily and cheaply remedied by placing every member of the fire department in electrical communication with the two chief officers or with the police department. But the horse difficulty can only be solved by the adoption of self propelled engines, because at the best of times horses are expensive nuisances in fire department work and cannot be driven so near a fire as a motor.

In many countries schemes are being considered by small townships and villages for arrangements with ad-

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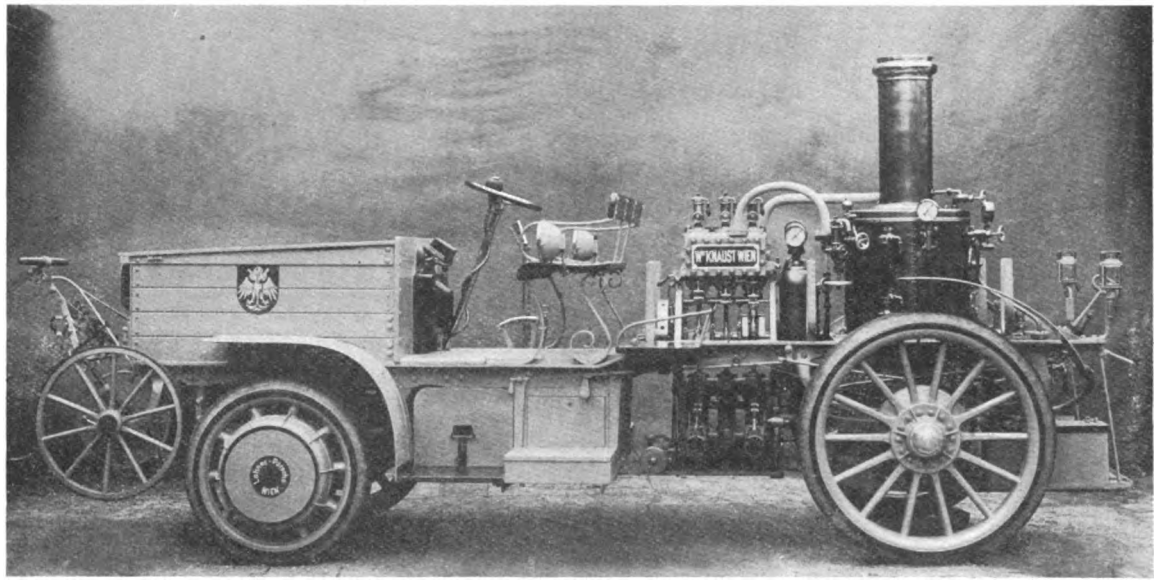
jcining large townships for regularly contributing towards always ready to turn out to country fires. Where a number of districts so combine the individual expense is small. Means of communication being provided a powerful engine would be able to reach fires all around the district in time to be of real service. Each of these engines could carry a chemical cylinder so as to be able to deal with fires where water is not immediately required or necessary, or may be entirely lacking, as often occurs in isolated districts.



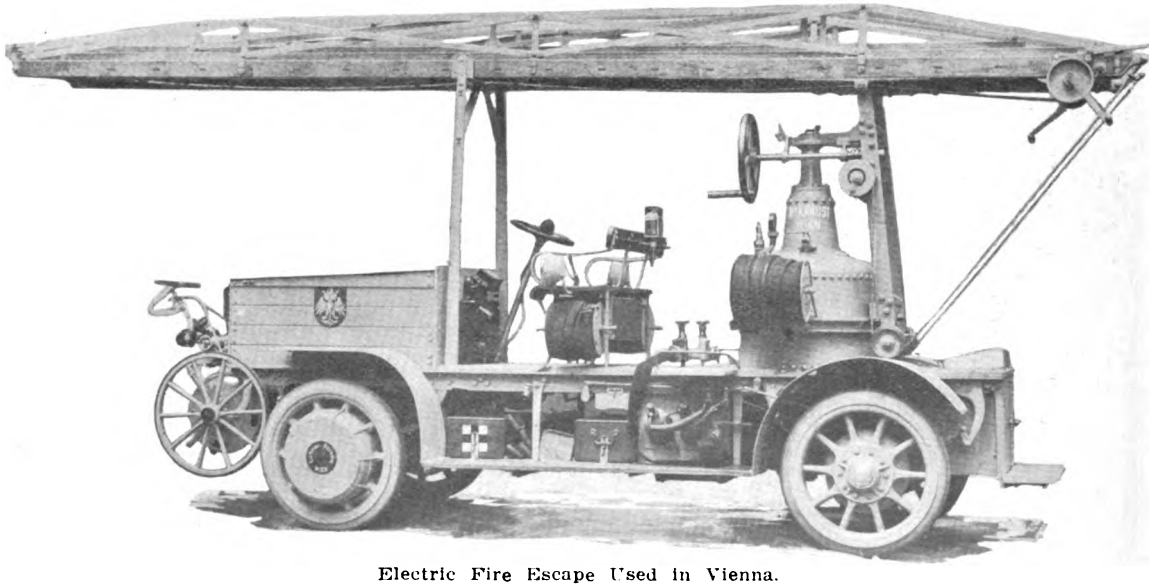
Electric Fire Engine Used in Vienna. Motors in Front Wheels. Range of Vehicle, 28 Miles; Speed, 12 Miles an Hour.

The manufacture of fire engines has hitherto been in the hands of a very few firms in three or four countries, but the advent of the motor as an adjunct to fire fighting systems has encouraged other firms to enter the business, and there is room for still more enterprise in this direction.

Few fields are more favorable for the use of the motor than is that of the world's fire department. The dominion of the horse is doomed. In place of the splendid animals, brilliantly harnessed and galloping at breakneck pace with swaying engines behind them through the streets of the world's capitals, already there is the swift motor threading its way through mazes of traffic with perfect safety to those on board and to other vehicles.

It is pleasing to note that in practically every case in which a motor fire engine has been installed it has been purchased not so much for its financial economy as for its annihilation of time and space, and possible economy of human life and property. It is, of course, manifestly impossible to give any general figures which should be correct for any number of towns and districts as to the comparative cost of upkeep of motor fire vehicles as against horse machines. Few fire departments have their own horses, as we have already pointed out, and where the horses are hired there is usually a contract made, either for a fixed sum per annum, or for a fixed charge to be made each time animals are required. In some country departments a contract for horse hire has been as low as $75 per annum, while in a district near London recently we noticed that $750 per annum was the contract price.

It was with the object of examining in a fair and impartial manner the arguments for and against the



Electric Fire Escape Used in Vienna.

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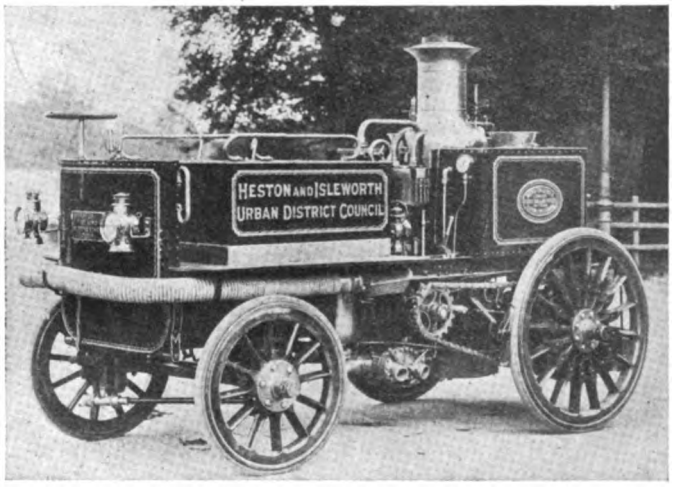
motor fire engine that this article was written, and thereby enable those who have no first hand acquaintance with the subject to form an opinion founded on actual fact.

Taking, first of all, the most important feature of the motor, speed—as it is this which enables the motor to save loss of life and property—no single hard and fast rule can be laid down owing to the varied conditions of traffic in cities, towns and open country. On a clear road a motor fire engine can develop easily 30 miles an hour, but in heavy city traffic this is considerably reduced. An average of 16 miles per hour, however, may be safely allowed for over all roads, cities included, although a far higher speed is often made without accident of any kind.

A motor, it has been shown, is able to leave the fire

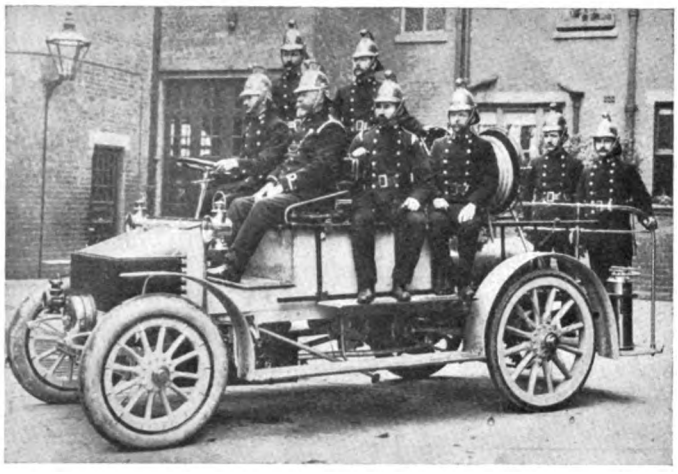


Motor Fire Engine in Use Outside of London. Capac ity 300 Gallons a Minute.

station without delay on receipt of a call. A fire department possessing its own horses is practically in the same position. Where the horses are contracted for delay, although it may be slight, is inevitable. The horses cannot make more than 9 miles per hour under the most favorable conditions. So that the difference between time of

Oil-Fired Motor Steam Engine Used in London. Capa city 500 Gallons per Minute.

arrival of the motor and horses, respectively, at the same fire, and traveling over the same ground, is considerably in favor of the motor. In hilly districts it is often impossible for the horses to make 4 miles per hour, but to



Combination Ladder and Hose Wagon Used in Leicester, England.

the motor hills make little difference. Eight miles per hour can be maintained on the steepest gradient as the engine power is not based on the effort of traction, for which it is more than doubly sufficient, but on the pumping power. The following figures respecting motor fire engines do not, therefore, represent the best performances:

Tables Showing Respective Times Occupied in Identical Journeys by Horse Drawn and Motor Steam Fire Engines.

1. Engines Starting Simultaneously.

Distance from Station	Horsed Engine	Motor
½ mile	3 min. 20 sec.	1 min. 52½ sec.
1 mile	6 " 40 "	3 " 45 "
1½ miles	10 " —	5 " 37½ "
2 miles	13 " 20 "	7 " 30 "

2. Horsed Engine Receiving 30 Seconds Start.

Distance from Station	Horsed Engine	Motor
½ mile	3 min. 20 sec.	2 min. 22½ sec.
1 mile	6 " 40 "	4 " 15 "
1½ miles	10 " — "	6 " 7½ "
2 miles	13 " 20 "	8 " — "

3. Motor Receiving 30 Seconds Start.

Distance from Station	Horsed Engine	Motor
½ mile	3 min. 50 sec.	1 min. 52½ sec.
1 mile	7 " 10 "	3 " 45 "
1½ miles	10 " 30 "	5 " 37½ "
2 miles	13 " 50 "	7 " 30 "

In every case it will be seen that the motor makes the best time.

There is on record an instance where a 300 gallon motor fire engine covered ten miles of a hilly district in a fraction under thirty minutes. A team of horses could not accomplish this feat in double the time. To the motor it was merely an ordinary run which could be repeated as often as necessary.

There is very little actual control over the horses when they are traveling at top speed; in fact fire-engine horses are very much inclined to run away. The only safeguard in such emergencies is a very powerful brake, which, although causing a little mischief to the vehicle

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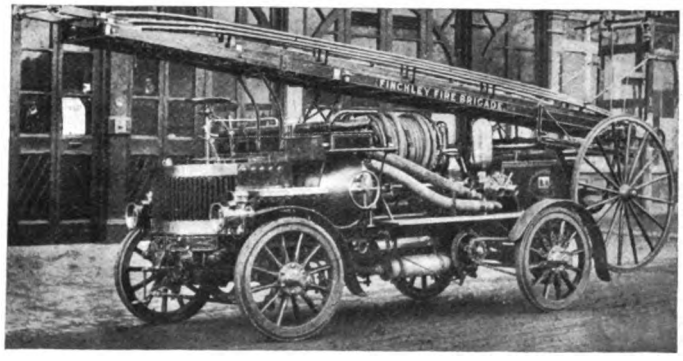
when suddenly applied, throws a great strain upon the animals. Where the animals have got out of control this is of little consequence, but where the brakes are applied for sudden emergency in traffic, as they are continually, the horses suffer more or less harm thereby. A motor fire-vehicle is always under perfect control, and can be braked in twenty feet, and less if necessary, without damaging the machine in any way. No horsed vehicle can be safely pulled up in so short a distance when making its best pace.

The dangerous swaying motion imparted to a horsed fire-vehicle when being drawn at the best speed of the horses is altogether absent from the motor fire-vehicle. On a frosty or slippery road, also, the latter does not slip and skid if properly tired, as does the horsed vehicle, owing to the unequal pulling power of the horses. Often the horses proceed at a walking pace over slippery roads, whether muddy or frosty, whereas the motor need not slacken speed for any cause but congested traffic. In heavy snow the motor fire-vehicle, as a result of its great reserve locomotive

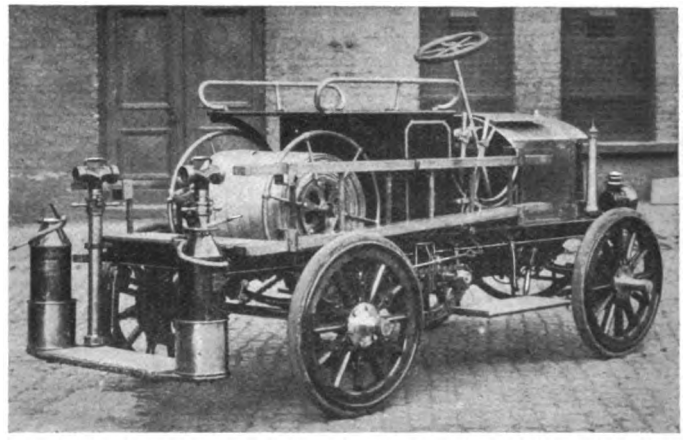


Motor escape and tender used outside of London.

power, easily ploughs through deep snow which would be absolutely impassable to horses.

The motor has greater stability than a horsed vehicle, principally because it is self-propelled and its center of gravity is very low, with the greater portion of its weight centered between the road wheels. The horsed engine has the greater part of its weight mounted on the rear and is pulled from the highest portion by the pole and sway-bars attached to a fore-carriage, which is consequently ever moving erratically with the alternating stride of the harnessed animals. This unequal tractive force, coupled with light forecarriage and dead weight at the rear, inevitably causes swaying and skidding. It is impossible to drive a horsed fire-vehicle at full speed for more than about 25 feet in a straight line.

The machinery, or boiler, or pumps of a motor engine are so arranged that in conjunction with the system of drive the tractive effort is administered through each road wheel in corresponding proportions. The power is applied direct to the rear road wheels from the center of balance whether the drive be by chains or gear. Where it is electric and by motors in the front wheels, the additional weight of the motors increases the stability and tractive power of the vehicle. But whatever the power system employed, a motor fire vehicle is practically uncapsizeable, the tractive effort is administered directly and smoothly, and with mathematical certainty. In theory and practice a motor fire vehicle

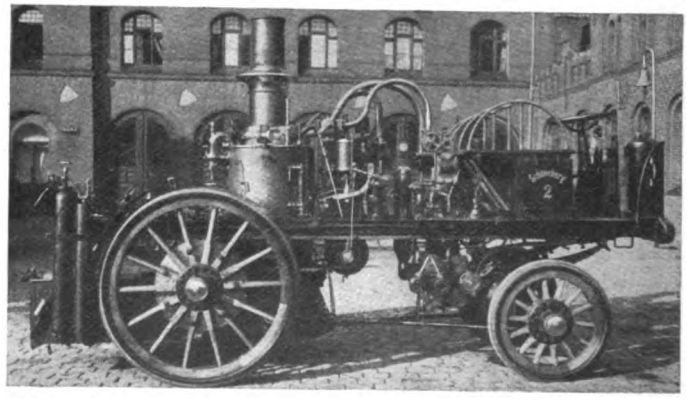


15 hp. Gasoline Motor Hose Wagon.

is incomparably a safer and better traveler than a horsed fire-vehicle, even apart from the greater utilization of power afforded by solid rubber tired traveling wheels. The tractive resistance of a road to such tires is less than to pneumatic tires and only 25 per cent. of the resistance offered to steel tires.

Stabling space is saved by a motor fire-vehicle. Moreover, more men are available for duty at a conflagration than is possible with a horsed vehicle, as valuable assistance is wasted by detailing firemen to take the horses home or to watch them.

Although in initial cost more expensive than horsed fire-vehicles, motors are infinitely cheaper in operation and maintenance. The horsed vehicle may to superficial observers appear to be much lower in cost in both these items, but a close study of the comparative charges on horsed and motor fire-vehicles will disabuse the mind of this idea. There is a great difference between the first cost of either type of vehicle, but there is also a vast difference between the actual cost of operating



Motor Fire Engine Used in Berlin.

and maintaining each type. On the horsed-vehicle side there is the advantage of low capital cost, but the disadvantage of high maintenance charges; on the motor vehicle side there is an apparent disadvantage of high capital cost, but there is a tremendous advantage of low maintenance charges and increased fire-fighting efficiency.

The cost of up-keep of a horse in fit condition for fire department work is under the most favorable

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circumstances not lower than $200 per annum. There are, however, comparatively few fire departments having their own horses, and where the animals are hired there is usually a contract made either for a fixed sum per annum or for a fixed charge to be made each time animals are required. In some rural fire department services a horse hire contract may be as low as $75, while, as we have already pointed out, a London district department recently fixed up a horse hire contract at $1,250, but in this case of course, more than one fire-vehicle is in use.

Allowing, however, two horses to an engine, and making no provision for reserve animals, the two horses used will cost $400 per annum. Added to this there is the cost of stabling, $250; attendants, $750; repairs to vehicle, $50; depreciation at 20 per cent. on horses costing $375 each, $150; depreciation on vehicle and harness costing $2,350 at 10 per cent, $235—total annual charges of maintenance $1,835.

The total capital cost of two horses and steam fire engine is, apart from the cost of building fire department offices and stabling, $3,100. It will be noticed we have only charged rental on the stabling and not on any residental property for firemen which may be attached.

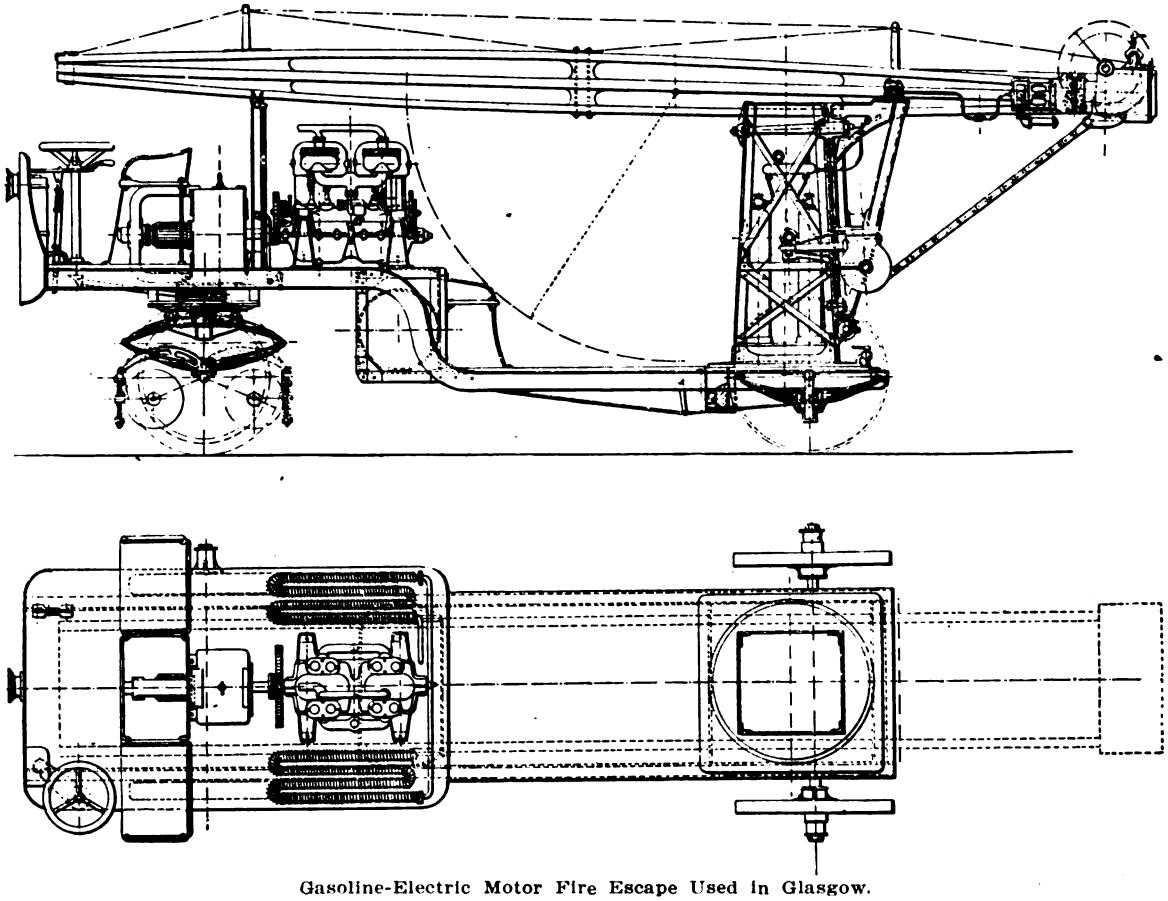
In ten years, therefore, the outlay on the horsed fire engines will amount to:

Cost of Operating Horses

Original cost of horses and engine,.....	$ 3,100
Ten years maintenance charges,.....	18,350
	$21,450

No charges are included for operation, as when working a horsed or motor fire engine or motor pump costs about the same for a given discharge of water per hour—if anything the advantage will be on the side of the motor vehicles.

The capital cost of a British 500 gallon motor fire engine is approximately $6,000. The maintenance charges will include one driver at $500; gas for boiler burner while in station, $90; repairs to vehicle, $75; fuel en route, $36; tire renewals at six cents per mile on 3,000 miles per annum, $180; stabling $125; depreciation at 10 per cent on capital cost, $600—total annual maintenance charges $1,606.



Gasoline-Electric Motor Fire Escape Used in Glasgow.

In the case of a gasoline motor the charge for fuel in station will be unnecessary, but as the price of the fuel en route will be higher and the consumption greater, the figures for this item may be allowed to stand. The gas burner is required for the oil fired steamer while in the station in order to keep the water continually heated and ready for a call. The gas burner is kept alight in the fire-box day and night, maintaining a supply of steam at low pressure, a full head of steam being obtained as the engine travels to the fire. The oil fuel is only used when the engine is actually at work, that is, traveling or pumping. The comparative advantages of other types of motor driven engines it is not necessary to mention here beyond their relation to horsed fire-engines, than which they are more economical in a greater or less degree.

(*To be continued*)

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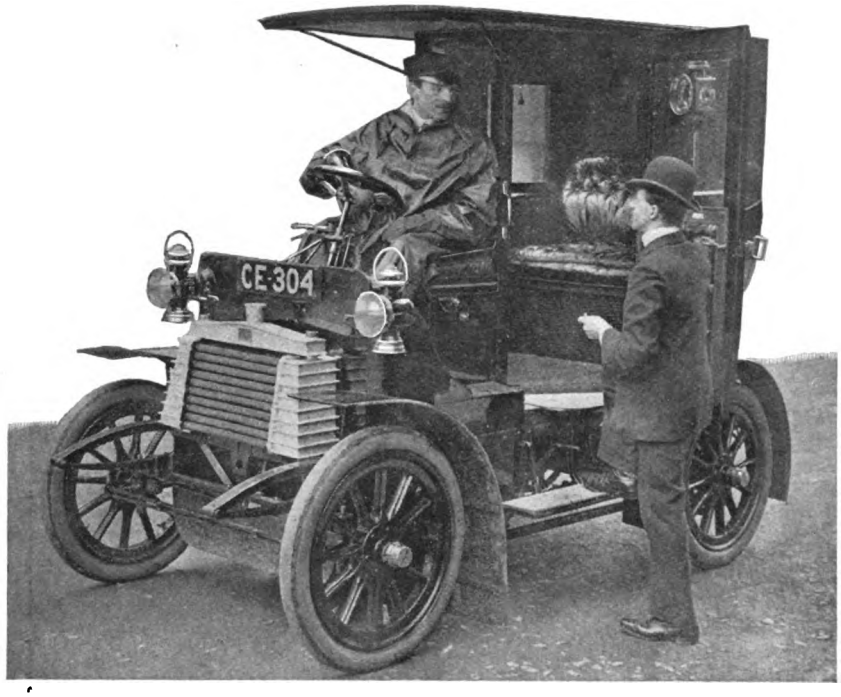

Public Service Motor Cab.

Taximeter Motor Cabs

Public Service Vehicles Fitted with the Taximeter more Profitable Than Old Style Vehicles

MOTOR cabs fitted with distance measuring devices known as taximeters are more popular on the continent than any other form of small public conveyance. The fare commences at 15 cents.

The taximeter, as in use on the continent, is a securely closed and sealed metal box containing mechanism actuated by a flexible shaft connected with the wheel of the vehicle, in the same manner as the speedometer upon a motorcar. It has, within plain view of the passenger, a number of apertures in which appear figures showing the amount payable at any time. A small lever with a metal flag bearing the word "free" stands upright upon it when the cab is disengaged. As soon as a passenger enters the cab the lever is depressed by the driver, showing that the cab is engaged and starting the recording mechanism. At the end of the journey the figures upon the dials show exactly the sum payable for hire. The instruments remain the property of the company, which lease them to the cab-owners, test them periodically, guarantee to keep them in accurate working order, and hold them always subject, at the works, to police inspection. No unauthorized person can obtain access to the mechanism.

Evidence was tendered to the effect that a dishonest person could tamper with the driving mechanism on the wheel, and thereby cause the dial to record unfairly against the passenger. But in view of the facts (a) that the greater part of the sums thus dishonestly procured would go to the cab-owner and not the driver; (b) that such tampering could not remain undiscovered for long—an acute passenger would quickly perceive that he was being overcharged; and (c) that such dishonesty would involve the offender in severe punishment, we are of the opinion that this objection is unimportant. Moreover, it has not been found to exist in practice in the continental cities where the taximeter is in almost universal use.

We have received important evidence of the working of the taximeter in Berlin, Hamburg, and Paris, from the report of five delegates of the Federation of Associated London Cab Proprietors, who visited those cities to make special investigation. These gentlemen report that in Berlin there are 8,500 cabs with the taximeter, and only 250 without it. The instrument, they say, "is practically compulsory in Berlin, by force of public opinion, and the use of the apparatus has increased by 3,000 in eight years." "The general public," they add, "are delighted with the arrangement, and disputes between hirer and driver are reduced to a minimum; and notwithstanding that the trams have been electrified for three years, and the fares are extremely cheap, cab-riding has considerably increased." Finally, they quote the following opinion of the chief of police of Hamburg:

"The following is our experience made with the taximeter in this town. The apparatus, which was introduced in 1891, has worked very well indeed. A few little derangements in its working are easily put to rights. The fare is calculated automatically by the apparatus and shown in one sum. The parties using the cabs are saved all the trouble of studying complicated tables of fares, or of having any discussion about same

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with the cabman. This circumstance has evidently thrown quite a new life into the use of cabs in Hamburg.

"The fact that the normal fare is always exactly known has caused the public to make use of cabs for much shorter distances than formerly. We certainly consider that no table of fares, either by time or by distance, can be regulated so exactly as can be shown by this taximeter. Any improper use of the apparatus by the driver is absolutely prevented by special mechanical arrangement."

From Paris the report of the delegates is of a similar nature:

"The receipts under the new system compared favorably with the old tariff as six against eight; the receipts taken at the worst moment of the year is obviously superior to that of other cabs. Greater increase of short fares. The wear and tear of horses not greater. Cabs with taximeters more readily taken out by the drivers. Prior to the introduction of taximeter an average of 15 per cent. cabs at home, and it was the cabman who demanded the taximeter."

The representative of a taximeter company in Paris says: "We started with 1,000 taximeters in the streets. It was an immediate success. Within three weeks of the very first day of the appearance of the taximeter in the streets we had an order for 3,000 more; and now there are running about 8,500 taximeter cabs in Paris out of 10,000 to which the apparatus could be fitted. We were late for delivery because we had a large number to deliver in a very short time, and all came to me, telling me, 'I want my taximeters, because my drivers will not go out into the streets without the taximeter.'"

The taximeter is a necessity with the motor cab, as it is essential that the public should know exactly, without discussion, what they are called upon to pay. The fare by distance should be slightly higher than for the horsed cab. But obviously the fare by time must be much higher, as the motor cab might cover 15 miles within the hour. This case can only be satisfactorily met by the adoption of the hour-mile taximeter system. In motor cabs no extra charge should be made for additional passengers as there is no horse to be considered. A folding seat should, therefore, be permitted in the interior of the motor cab.

AN INPEDIMENT REMOVED

LAST year gasoline power wagons were denied admission to the wharves and docks of the water front in New York upon the ground that the fuel of the vehicles endangered the adjacent shipping property. Objection to the presence of these vehicles was not offered by the fire or city authorities, but by the steamship companies which deemed the presence of gasoline motor vehicles a menace to their insurance.

Now, however, the scruples of the steamship companies have been overcome, investigation having shown that the machines do not endanger property or imperil insurance.

BIG FLEET OF BUSES

THERE are more motor buses in London than there are street cars in any but our very largest cities. At the last census the distribution was found to be as follows;

London Motor Omnibus Co.	151
London Road Car Co.	96
London General Omnibus Co.	98
London and District Motor Bus Co.	44
Thomas Tilling	31
Great Eastern London Motor Omnibus Co.	39
Star Omnibus Co.	23
Associated Omnibus Co.	23
London Power Omnibus Co.	25
Birch Bros.	15
New London Suburban Omnibus Co.	9
Victoria Omnibus Co.	8
Other owners	47
Total in use	609

TRUCK TO CLIMB A MOUNTAIN

MOUNTAIN climbing is sufficiently novel work for a five-ton motor truck to attract more than ordinary attention. At a cost of $5,000 G. W. Richey, superintendent of construction in connection with the Carnegie observatory which is to be built on Mt. Wilson, Cal., has given the order for a special wagon to be built by the Couple-Gear Freight Wheel Co., of Grand Rapids, which is to be ready by the fall.

The machine will first be used for improving the mountain trail and later to carry material to the top of the mountain, which means a climb of more than a mile. During the fall five hundred Mexicans will be employed widening the trail to eight feet to admit of the passage of the truck. The observatory is to be connected with the Carnegie institute at Washingon. To provide for the telescope and the observatory it will be necessary to carry several hundred tons of structural steel to the top of the mountain.

IN THE MINING REGIONS

MINING experts declare that automobiles are playing a great part in the development of the mineral deposits of Nevada, and in this direction are rapidly supplanting the patient burro and horse.

Prospecting there was practically at a standstill until the advent of the motor car. The greater part of the Nevada region is level, but the water supply is limited to springs few and far between. A prospector who used burros had to carry water for both himself and animals, and slow as the burro is, the prospector could not hope to make more than 30 or 40 miles before returning to his water supply. This limited his work.

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Establishing Reliability

Brilliant Performance of Motor Truck in Course of a Lengthy Journey over Country Roads

WHEN it is shown that a gasoline motor truck with load varying from 2,000 to 3,300 pounds can be continuously operated for 2,007 miles in a little more than 196 hours—which represents an average speed of ten and one-quarter miles per hour—at a repair cost of $6.50 and a fuel and lubricant cost of $77.35, its reliability in service can hardly be challenged.

Although such a demonstration, failing to take note of wages and administrative charges, may not definitely establish the economy of the gasoline motor truck, yet the record is so strongly indicative of it that few will have hardihood to deny that it is as good as proven.

The occasion for these remarks is furnished by the work of the Knox truck which recently accompanied the Glidden tourists, carrying their baggage from point to point in the course of each day's itinerary.

Ordinarily we are not impressed by the showy information collected and tabulated by professional demonstrators of commercial power wagons. In the first place such demonstrations are usually hastily contrived and disadvantageously performed. As a rule the demonstrating vehicle is not required to exhibit its maximum efficiency, the routing in the majority of cases being more suitable for experiments with draft animals than power wagons. In the case under consideration, however, no claim was made for special adaptation of the vehicle to service. The exhibition, therefore, was largely in the nature of a test to prove what efficient handling could do for a motor truck under adverse and unknown conditions where precision of service was a chief consideration. In this respect the showing made was brilliant. The economy of motor wagons being a matter which is intimately mixed with the care and administration of the machines, it would be absurd to pretend that an uninterrupted journey of 2007 miles could be anything more than a registration of dependability, which as all know is one of the decisive factors in determining economy.

It is a pity that the concern which braved the criticism that naturally attended an undertaking of this sort did not attempt by practical experiment to show to what extent the power wagon was superior to the horse in exactly the same service. It is, further, a pity that it did not compute the full cost of operation, wages of driver and overhead charges included, in order that the hidden values of such a demonstration might become known.

No doubt the trip was conceived in the nature of an advertisement, but this admission need not cause any misgivings touching the accuracy of the material facts elicited.

It is unnecessary to follow the truck through every stage of its itinerary. It is enough to say that roads which were considered impracticable for heavy motor vehicle traffic were traversed with comparative ease; that the whole journey was accomplished without mishap of serious or noteworthy character; and that for a second time this enterprising establishment performed the worthy service of drawing attention to the value of the machine in long distance and interurban merchandise road transportation.

The following table is perhaps the clearest exposition of what transpired on the trip, at least from the viewpoint of a business man:

Total distance, miles	2007
Total running time, hrs. and m.	196; 6
Average miles per hour	10¼
Gasoline, 255¾ gals. at 25 cents	$63.94
Lubricating oil, 17⅞ gals. at 75 cents	13.41
Replacement two exhaust valve springs	1.00
Replacement one spark plug	.50
Replacement four dry cells	1.00
Replacement one spring leaf	4.00
	$83.85

Average cost per mile, 4 1-6 cents.

ANOTHER RAILWAY CONVERTED

THE Southern Pacific railroad, after using one of the Union Pacific's gasoline rail motor cars, has concluded to buy several of the twenty U. P. cars now being constructed in Omaha and put them in service on the Napa Valley electric line, supplementing the present service, and on the cut-off between San Francisco and Santa Cruz, Cal.

The New Haven, Conn., chief of police has recommended the purchase of a police and ambulance motor wagon as a substitute for the six horses and wagons now employed by the department.

Motor bus service is connecting Portland, Me., with Crescent Beach and Two Lights.

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Gasoline Electric Vehicles

Interesting Features of Two Designs Which Have Attracted Much Attention

YEARS ago experiments were conducted in this country to establish the value of gasoline-electric transmission in automobiles. The work was permitted to drag and the enthusiasm which it aroused soon petered out. Of late, however, interest in the subject has been revived upon observing how eager and how successful foreign engineers are in developing this mixed method of transmission.

We are given to understand that one of the largest concerns in this country has in contemplation the construction of commercial vehicle chassis fitted with gasoline-electric transmission. This firm's engineers contend that the early experiments with the mixed transmission were conducted at a time when neither the gasoline engine nor the electrical equipment was developed to the point observable today and that in consequence thereof the expected results were not forthcoming. Now, however, the situation is much more favorable, and it is confidently expected that success, both commercial and mechanical, will attend the effort to combine the advantages of both forms of energy.

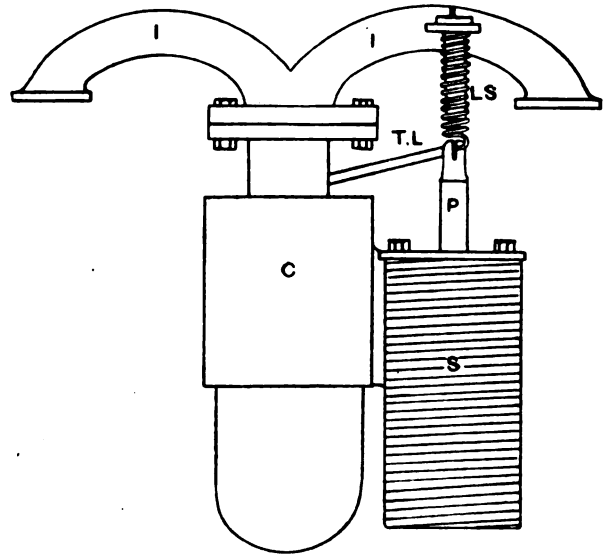
Probably the greatest of all difficulties has been the inherent troubles of continuous-current electricity on series-parallel control systems. The mixed system has been successfully applied to electric traction on rails, where the current is derived from a central generating station at constant voltages, and where the weight and horse-power of the electrical equipment is relatively large. An isolated and self-contained unit presents an entirely different proposition. Again, in the case of a self-propelled vehicle running on common roads, the irregularities of the surface cause considerable sparking at the brushes, with resulting damage to the insulation of the windings. All gasoline-electric vehicles so far have, in short, left a great deal to be desired. They have been complicated by the presence of accumulators, commutators, brush gear, ponderous controllers, numerous switches, and a marked absence both of simplicity and utility.

* * *

The Hart-Durtnall system, to be presently described, is free from many of these disadvantages. It was designed especially for road vehicles of all kinds. The makers have been guided in their construction by the following principles: Minimum weight compatible with strength, and the absence of high motor speeds; avoidance of any severance of the main circuit; non-employment of an expensive and cumbrous controller; facility of securing a variable torque on the driving axle, particularly at low motor speeds; gradual and smooth start from rest, accompanied by rapid acceleration apart from any personal ability in the driver; absolute elimination of accumulators; and immunity from the usual overheating troubles. These ununqestioned advantages have been brought within the range of practical use by the adaptation of polyphase alternating currents to the necessities of self-contained and self-propelled road vehicles. The result is a system which has no change-speed gear, no foot-clutch control, and no batteries.

This highly desirable state of affairs has only been gained after prolonged experiments over a period of no less than four years. The Hart-Durtnall system for road work consists essentially of five parts. These are: (1) an ordinary internal-combustion engine of multi-cylinder type; (2) a small continuous-current dynamo, driven off the crankshaft by suitable means, and wound to provide a variable current at variable voltages, this type being utilized for excitation purposes; (3) a polyphase multipolar alternating current generator designed to receive current from the exciter at variable voltages; (4) a motor permanently coupled by copper leads to the generator, and arranged to gear with the differential shaft or live back axle of the vehicle; (5) a magnetic clutch located between the generator and the motor.

The engine gives 40 hp. at 800 revolutions. Any make of engine can be employed with this transmission system. No special feature is required in the engine itself, except the removal of the fly-wheel, as the fly-wheel action is provided by the revolving magnets of the generator. The usual system of solenoid control can be readily applied to control the gas admission to the cylinders, and inserted in the exciter circuit so as to open or throttle in proportion to the work being done round the windings of the generator magnets. The shaft of the generator on this engine is coupled to the crankshaft by flanges bolted together, but a universal joint can be substituted for use in any vehicle. The generator shaft has on its rearward end one member of the electro-magnetic clutch, and the necessary slip rings for conveying the current to the coils inside the clutch casing. Thus, when the engine is revolving, the generator shaft turns with it



The magnetic control of the gas supply on the Auto-Mixte 'bus.
C, carbure ter. I, inlet pipes. S, solenoid.
P. plunger. L S, light spring T L, throttle lever.

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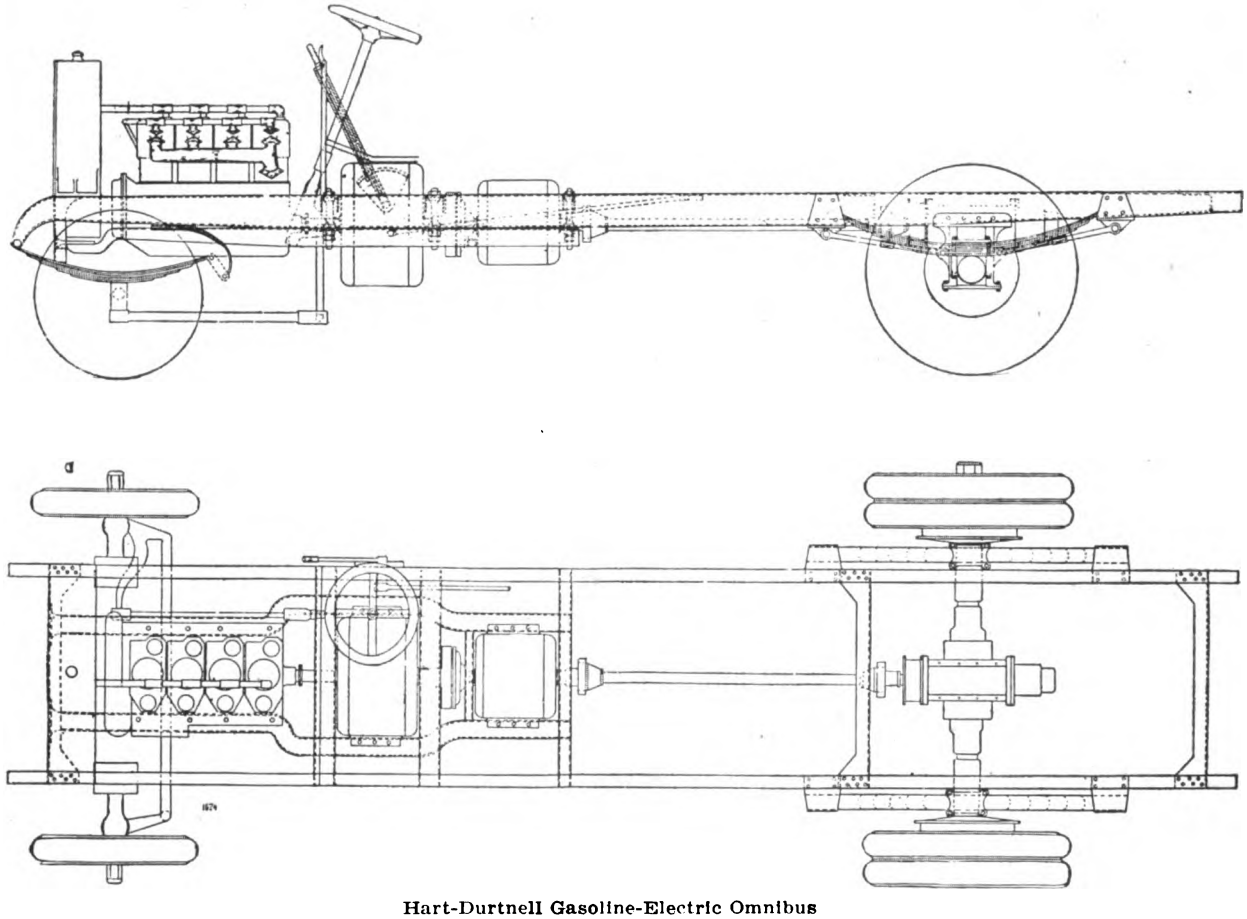
as far back as the center of the clutch casing. The exciting current from the small dynamo, which is driven off the engine crankshaft, is conveyed to the generator magnets by a pair of slip rings which are placed inside the generator casing.

The whole control is obtained by a single lever, which, in this case, gives nine variations of the current and voltages supplied to the generator magnets. In operating the system the engine is started up in the usual way by hand. If thought desirable, a few small cells can be fitted to start the engine by means of the exciting dynamo, which is then temporarily run as a motor. As soon as the driver gets on his seat—until which time the windings of the exciter are short-circuited, and a powerful drum brake is automatically held on—and moves the control lever to the first position, the first degree of excitation is applied to the generator, and the emergency brake is released. The car, unless on an incline, when the lever might require to be put to the second position immediately, then begins to move, and the driver can speed it up by moving his control lever further forward, and thereby further exciting the generator magnets.

Up to this point the magnetic clutch is not in action, and the alternating current from the generator is conveyed by means of the three fixed copper bars to the electric motor. When fully speeded up, the next position on the controller puts the clutch winding in series with the generator magnet windings, and so drops the clutch coils in circuit with the exciter, while weakening the field of the generator. A further movement, which is made almost immediately after the preceding one, to the last controller position, short-circuits the windings of the generator magnets, and allows the clutch coils to receive the full current from the exciter. The electric transmission is then eliminated, and the driving is entirely mechanical.

It will be observed, therefore, that the electrical equipment is primarily designed to take the place of change-speed mechanism, which it does with an approximate loss of 28 per cent of the power generated by the engine, but there is only the single-reduction loss to the differential shaft or live axle of a vehicle during the great majority of the time that the vehicle is running on the road.



Hart-Durtnell Gasoline-Electric Omnibus

The sequence of operations is reversed, or varied, according to traffic conditions, and the vehicle can be driven in a backward direction by reversing one phase of the alternating current motor. This is accomplished by pulling over a small reverse lever. Breaking power is at all times available, as explained later.

The total weight of the generator, motor, and casing, ready for dropping into frame, is 1,099 lbs. Although somewhat heavier than the parts they would replace in an ordinary heavy motor wagon, namely, the fly-wheel, gearbox, clutch, change-speed shafts and wheels, and the connecting levers thereto with the necessary rods and brackets, it must not be overlooked that the absence of shocks to the transmission should more than compensate for this slight extra weight, while the wear and tear upon the body, tires, and the chassis generally, should be largely reduced.

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The novelty of the system lies in the application of polyphase alternating current apparatus to a self-contained vehicle; the disastrous effects of sparking are avoided, while the enormous weight and complication, which characterizes so many of the gasoline-electric systems already on the market, is entirely absent. The inherent advantage of lower weight, power for power, which polyphase motors possess in comparison with continuous-current motors, must also be noted.

The Hart-Durtnall system takes advantage of the well-known electrical law that doubling the voltage of the current supplied to a motor results in a multiplication of the useful torque by four, and the value of this should be particularly apparent when climbing gradients. The whole system is compact and free from parts likely to wear, so that its maintenance should be exceedingly small.

Another feature is that the generator and the motor tend to keep in phase with one another. Thus, in starting from rest, the motor, of its own accord, owing to its physical aptitude to get into phase with the generator, follows the movements of the control lever from position to position, without any irregularity. This quality also comes into play when running down-hill, because the generator then holds the motor back, and has a retarding effect upon the mass of the vehicle. This characteristic, that the generator and motor naturally incline to keep "in step" with one another, does not occur in the case of continuous-current systems, and is a unique and welcome advantage.

The inter-automatic electrical braking depends upon the peculiar qualities of alternating currents. When gravity is acting on the mass of the vehicle upon a declivity, the axle tends to turn the motor in advance of the generator magnets, but the alternating current from the generator, because of the then lower frequency of its periods, tends to hold back the motor, which is trying to over-run it. By increasing the excitation current at such times, a braking effect, equal to the power of the engine, can, if necessary, be obtained. An unskilled driver has no strain upon him, as he merely has to move the control lever; his work should be more easy than that of an electric street car driver.

* * *

The Pieper system is another interesting example of gasoline-electric transmission suitable for heavy vehicles. Its power is obtained from a 14 hp. four-cylinder gasoline motor, and an 8 hp. dynamo motor, with a "buffer" battery of secondary cells. These are designed to stand an extremely heavy discharge for short periods. Although having a capacity of only about 50 ampere hours, the rate of discharge frequently exceeds 150 amperes, and we are informed that it may occasionally be as high as 350 amperes without damage to the cells. As might be expected, this accumulator is somewhat heavy for its capacity, but as only a small battery is required this point is not of importance.

The control of the vehicle is extremely simple. A side lever works in a quadrant, having a number of notches for the various speeds and operations. The back notch is for the reverse; in the next position the engine is stopped; the third is a neutral position; the fourth a first speed forward; and nine more notches give further variations of speed. The movement of this lever first starts the engine through the agency of the electric motor driven from the "buffer" battery through resistances which are cut out of circuit as the lever moves forward, so that the electric motor cannot take an excessive current while gathering speed. The lever is pushed into the first or second speed notch, and the magnetic clutch is then let in, the drive being taken up softly and quietly. Subsequent movements of the control lever do not cause sudden, but gradual, changes, quite unlike the effect of changing gear.

While running, the needle of the ammeter is perpetually on the move—now rising to a maximum, showing a discharge at something over 150 amperes; now falling to zero; and, again, sinking below this point, showing that the batteries are being rapidly recharged from the gasoline engine. The speed of the vehicle on up and down grades is wonderfully uniform, the regulation of the power being almost entirely automatic.

The supply of gas to the carburetter is controlled by electro-magnetic means. Those who are acquainted with the mechanism of an arc lamp will have no difficulty in understanding the effect of the opposed series and shunt windings on the solenoid. Into this solenoid—a hollow tube carrying two coils of insulated wire—dips an iron plunger. When current flows through one of the coils, the solenoid functions as an electro-magnet, sucking down the plunger towards a central position. When a reverse current flows through the other winding, the magnetic effect is decreased, and the plunger rises under the tension of a light spring, moving the lever which controls the supply of gas.

When the "buffer" battery is fully charged the current in the shunt winding is sufficient to act on the plunger so as to shut off the gas to such a point that the engine will no longer give excess power to continue the charge. While the battery is discharging the series winding acts in opposition to the shunt winding and obliges the gas to open full, and thus the engine takes up the load and refuses the "buffer" battery to do more than its fair share of work. These operations go on automatically.

THE TRAINING OF DRIVERS

ANOTHER sagacious remark of the general manager of London's biggest motor bus company is as follows:

"If a man comes to me for a job dressed up in leather suit and gaiters, I won't have anything to do with him. No; we teach our own horse drivers, many of whom have been with us for years, although I always wait until a man shows some desire to go in for motor driving before having him taught. Our own men are better disciplined than any hired chauffeur, and, from their past training, are cooler when in a tight corner."

William Michelstetter is promoting a motor bus line from Appleton, Wis., to Seymour, by way of Little Chute.

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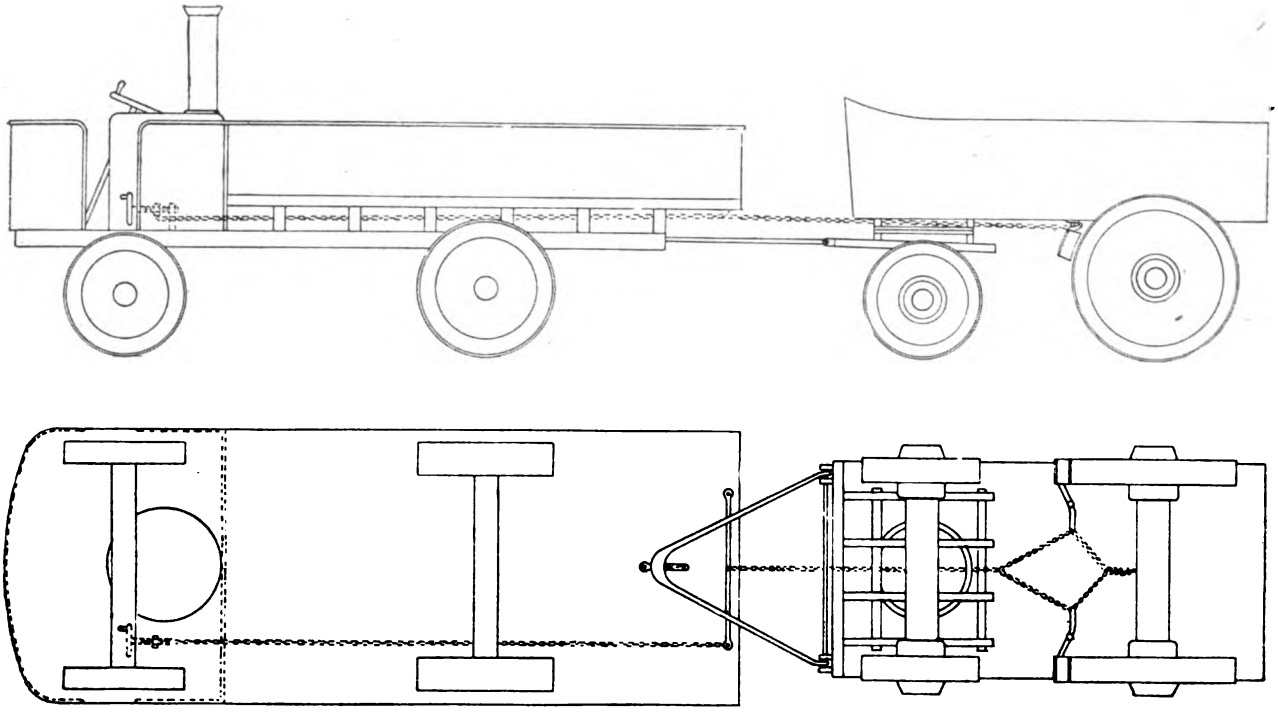

Fig. 5. Trailer Brake of Swiveling Type, Applied by Screw and Nut.

Trailer Brakes

Additional Simple Methods for Insuring the Safety of Trailing Vehicles

TWO illustrations appeared in our last issue showing simple methods of applying a trailer brake from the foot-plate of a power wagon. A further method is illustrated in Fig. 5. It requires a long horizontal screw, with a nut, to which the brake chain is attached. The nut can be made to pull direct on the brake chain, or it can be arranged to secure a further mechanical advantage by attaching it to a lever at the back of the wagon body, as actually shown in Fig. 5. The lever is hinged at the off-side of the wagon; the chain from the screw nut pulls at the extreme end of the lever, on the near side of the wagon, and the trailer brake chain is connected to the middle of the lever. The pull from the screw is, therefore, doubled by this arrangement. The two drawings published in our last issue illustrated trailer brakes of the hanging type.

The arrangement shown in Fig. 5 is far preferable to the hanging beam, both on the score of efficiency and weight. A forged steel arm is pivoted on the wagon frame, and pulled on by a chain. A short steel link is employed to equalize the pull on the two brake blocks. The brake is held off by a stout spring, close to the brake blocks, or in the center of the axle tree, as shown in the figure.

A modification of this system is illustrated in Fig. 7. The shape of the well requires a long extension from the brake block, with the necessary guides.

It will be seen, from the foregoing, that it is easy to alter the brakes of an existing horse drawn vehicle without affecting its efficiency as such and to which it may again revert on occasion.

A highly ingenious automatic trailer brake has been adopted by a large firm of brewers, which has a fleet of five power wagons. The apparatus, which is illustrated in Fig. 8, is designed so that the trailer puts on its own brake directly it begins to overrun the motor wagon. A spring drawbar is employed, in which the spring eye-bolt is allowed an extra four inches of clearance; the other end of the bolt has a knuckle joint carrying a connecting bar leading to the upper end of a reversing link on the drawbar pin. The brake chain is connected to the lower end of the reversing link through a long spiral spring. The brake is held off by the brake spring so long as the power wagon is pulling, but if the motor is suddenly checked the trailer will push the drawbar close up to the eye, so that the eyebolt will push back the top end of the reversing link, and the bottom end of the re-

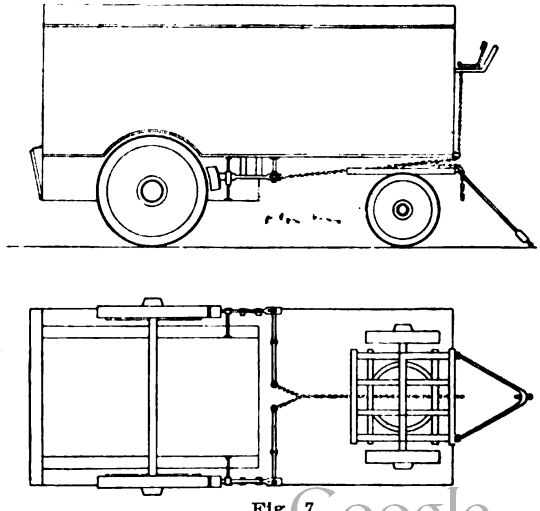

Fig. 7.

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versing link will pull on the brake. Immediately the motor wagon moves on again the brake will be automatically eased off before there can be any pull through the drawbar. Similarly the brake is automatically applied whenever the trailer overruns the motor wagon on a down grade.

Another interesting form of brake was on exhibition at a recent show where it attracted considerable attention. The general details are shown in Fig. 9. By

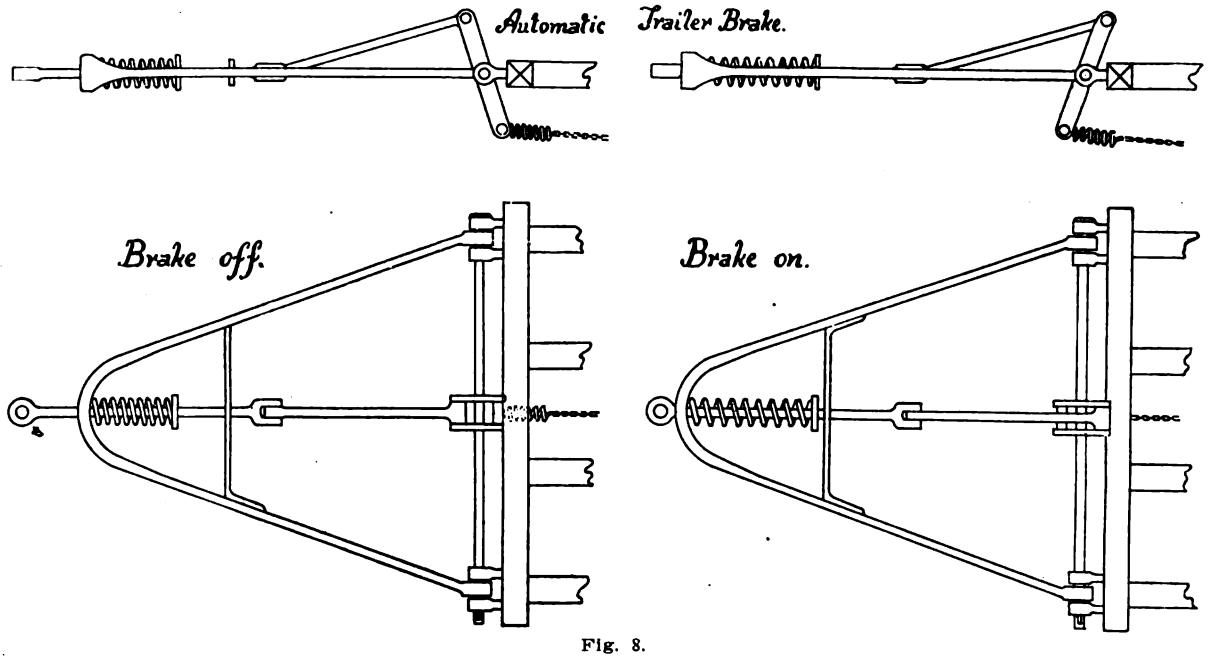

Fig. 8.

turning the brake handle the longitudinal shaft (C) is made to revolve by the two bevel wheels (B). In addition to the usual spring drawbar (H) there is a long sliding coupling (E) fitted with a universal joint (D) at each extremity, which is connected at its fore-end to the shaft (C). The rear end is attached to a shaft (F) which is threaded for a portion of its length. A nut works upon this portion and is connected up to two levers carrying the brake blocks (G).

The main feature of this device is the positive rotary motion which is obtained by means of the universal joints, no matter what angle the trailer makes with the wagon. The whole arrangement is extremely simple in design, and powerful when in use.

A trailer should not be used unless its brakes are in good order. It is not fair to let the weight from behind push against the drawbar pin of the pulling vehicle, and thus rely solely on the power wagon brakes. Though generally able to hold against the extra load, it is risky on mechanical grounds.

FUTURE CITY PASSENGER TRANSPORTATION

IT appears that the self-propelled omnibus has come to stay. It has been on trial in London over a year now, and experience proves it to be the street transit agency of the immediate future. With all its faults it is coming into more and more general use, and is serving the needs of hundreds of thousands of people. It ministers to the needs of the population in the congested districts of the city. The motor-omnibus will have to be made safer, quieter, and less odorous, and when these improvements are effected, as they certainly will be as promptly as possible, it will become the principle means of transportation for passengers.—Philadelphia Telegraph.

Five public service road machines are to be operated in Columbia, Tenn.

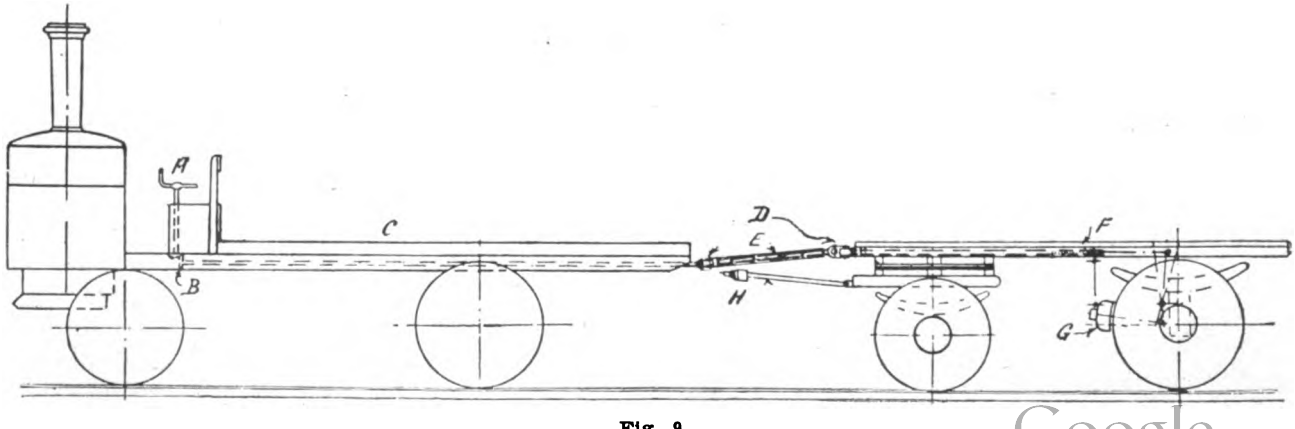

Fig. 9.

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Faulty Bus Design

Brakes and Steering Gear of Foreign Machines Put Lives of Passengers in Danger

ONE of the first fruits of the motor bus fatality which recently shocked the foreign public accustomed to the use of these popular machines is the sharp catechism of constructors by operating engineers concerning the efficiency of present braking devices and steering gear. The inquiry has resulted in the disclosure that neither form of mechanism is adequate for the purpose of public safety.

The chief engineer of one of the largest motor bus companies severely arraigns the manufacturers of all buses for neglecting to so design brakes that they will be accessible at such times as the vehicles are inspected for road service.

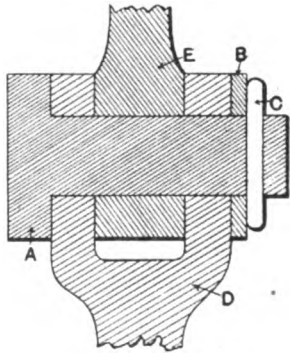
Generally, the brakes of the different types of buses are two—one acting on the hind wheels, the other on the differential. This in case of a chain drive car. When chains are not used for transmission, the brakes are one on the hind wheels, the other on the cardan shaft or propeller shaft. In all the types of buses actually running in London there is not a single accessible brake, especially those placed on the cardan or propeller shafts and on the differential.

They have another big inconvenience. Placed, as they are, next to bearings, directly there is the slightest oil leakage from the bearing the brakes do not act. The car is reported by driver as "no brakes acting," and the repairman, instead of first cleaning and testing the brakes, will simply tighten them up, and thus not only wear them out quickly, but after this operation the brakes are very soon as bad as before. When a car comes in reported by the driver as defective in braking power, the fitters have first to wash the brakes out, then the foreman in charge takes the car out, and tries the brakes. If they are not acting, they are adjusted in the ordinary way.

Internal brakes for bus work are (this is the result of experience) bad, because of their inaccessibility. The adjustment is long and difficult. Frequently the chains and wheels have to be removed, and when all is replaced the brakes often do not act, or are terribly fierce. The impossibility of the driver adjusting his brakes on the journey, moreover, renders them most objectionable.

The actual system in use for the foot brakes is generally of the type known on the continent as *frein a machoires*. In this, the brake acts on two drums keyed to the differential shaft, or on one drum keyed to the propeller or cardan shaft. These drums are not large enough, and when the brake is applied they become greatly overheated. Some of them get red-hot. The diameter of the drums ought to be considerably increased, with water-cooling, if possible, for, with the small diameter drums frequently in use at present, there is a permanent danger of setting fire to the bus. It would be possible to have a hollow drum full of water which could be replaced every day; this system would save the bearings and prevent fire.

The foot brakes are generally connected by rods which are not strong enough. The driver uses this brake twenty times more than the hand brake. The brakes on the hind wheels are also connected by rods or steel cable, and here again the rods are not strong enough. These brake rods should not in any case be tubes in which solid forged ends are brazed, for then, by constant use and vibration, the ends break or shake loose, as has happened in many buses. The brake rods, by the constant vibration, break in the center without any warning. This can only be explained as due to crystallization of the steel—the same phenomenon as occurs to railway metals. The connection of the brake rods is made by steel pins, washers, and split pins. These should not only be inspected every night, but during the day, for the pins may come loose and drop out, leaving the brake disconnected, although everything was right in the morning, and the results from such lack of proper inspection may easily be very serious.



A, pin. B, washer. C, split pin. D, brake rod with a "double-eye" end. E, brake rod with single eye end.

Knuckle joint used in brake rod connections showing usual method of securing such a joint.

The steel cable, in spite of the contrary opinion, is certainly the better and safer, because:

1. The resistance of tension is stronger in the cable than in a steel rod of the same section.
2. There is no chance of breaking by crystallization of metal.
3. A steel cable is much more flexible.
4. It has the advantage of compensating the tension of brakes at once, and of causing them to work exactly the same.

The perfect fastening in use, cables being sufficiently large, makes a safe system. Precaution should be taken every morning to thoroughly oil all the parts of the cable which rub when the brakes are applied, and to use the same system as is adopted in mines, that is, replace the cables long before they are worn out.

Motor bus makers ought to study a third brake on the rear wheels—a brake which could be worked by the conductor in case of emergency. Moreover all buses which have to work on country roads ought to be built

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with special brakes not less than three in number. A brake could be perfectly adapted to the rear wheels, and made simply like a scotch, as in the olden times. This would certainly be very effective, and prevent accidents.

The types of steering mechanism used on motor buses are: Segment and worm or screw thread, screw thread and nut, and bevel gear with bevel sector. The segment and screw is hardly strong enough. All the stress is put on the spindle, and as the steering arm is keyed to the spindle its resistance to breaking stress at that point is considerably decreased. Another fault in this type of steering gear is the rapid wear of the sector, because the same teeth are in gear and at work all the time, and consequently undue wear is occasioned at one particular point towards the sector. This type of steering ought to be rejected and the screw and nut type chosen. The latter has the advantage of affording a very large bearing surface. After it is worn out it can be mended without great expense by running in metal. The bevel gear and bevel sector is very seldom used, but it has given good results on some buses.

In general the steering gear of motor buses is not strong enough, and it has been suggested that on the new types much stronger steering be fitted, and that each steering rod be forged in one piece, so as not to require brazed connections, which work loose after a short time. The arms should be made from the best metal, carefully forged and keyed. Certainly no manufacturer ought to build steering gear from medium quality steels. The best will never be too expensive, as the shocks to which these parts, in a seven-ton motor bus, are subjected are enormous.

Manufacturers of motor buses should not forget that they have a heavy responsibility, and that the safety of their machines lies largely in good brakes and strong steering gear.

MOTOR PARCEL DELIVERY

IT is quite likely that an extensive public motor parcel delivery service will soon be established in Indianapolis, The plan of action includes the operation of ten or more light wagons and trucks. Experienced men are engineering the project. Many of the large retail firms, though owning one or more power wagons, would be glad to avail themselves of the proposed service, as their machines are heavily overworked. The success of the Detroit motor parcel delivery service has awakened many keen speculative minds to the opportunities which many other cities present.

NATIONAL WASTE

AT the end of last year there were 7,938 mules employed in our army transport service. The long eared songsters were valued at $116 apiece, or bulked were worth $920,808. Consider the number of "spares," the mortality, the inefficiency in pacific military maneuvers, the throng of stable men and the forage and harness expense which this herd of animals implies, and then contrast it with the economy which could be attained if, say, a third of them were superseded by military power wagons. It is very likely that a million or more a year could be saved by the substitution.

GASOLINE CARS FOR ERIE ROAD

THE general passenger agent of the Erie Railroad has announced that his company will utilize the first gasoline cars now being experimented with in the east, on the stretch between Cleveland, Leavittsburg and Youngstown. The business between these points is very heavy, and the Erie has found it necessary to increase its train service several times of late. This route was doubtless selected to forestall, if possible, the plans of the Eastern Ohio and the Mahoning Valley Traction Companies, which are planning to co-operate on a through high-speed service between Cleveland and Youngstown.

TO BUILD POWER WAGONS

TWO well known personalities in the automobile field have decided to build power wagons. H. G. McComb, assistant engineer of the Olds Motor Works, and Schuyler S Olds, who was identified with the Olds sales department, have resigned their positions to manufacture commercial vehicles. They have obtained the necessary financial support, but the company will not be formed until Mr. McComb's return from Europe.

FOREIGN BUS IN NEW YORK

THE New York Transportation Company has imported a De Dion gasoline motor bus made in France. It will be employed in general service. Should it prove satisfactory it will eventually be commissioned to operate on the Fifth Avenue line.

MORE ELECTRICS FOR ADAMS EXPRESS

ELECTRIC wagons will replace the present horse-and-wagon service of the Adams Express Company in New Haven, Conn. Ten power wagons will be installed. For some time past workmen have been busy at the horse barn putting it in readiness for the new system, and have transformed it into a first-class garage.

PROFITABLE ENTERPRISE

THE success of the motor bus line operating between Pittsfield and Lennox, Mass., will probably lead to the general adoption of this mode of travel in the Berkshire hills during summer and fall.

Although only one 14 passenger gasoline machine is now in service, making four trips daily, three more buses will soon be operating in greatly extended service among the Berkshire resorts. The route from Pittsfield to Lennox is over a state highway. The route is 6 1-2 miles long. An occasional run is made to Albany, 39 miles distant.

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Gasoline Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Their Attention

SQUEAKING springs result from rust or dirt between the leaves or at the pivots. Greasing the springs is a troublesome job, but it is a labor that effectually puts a stop to the nuisance. The wagon is jacked up by placing the jacks under the body instead of under the axles, as usual, in order to take the weight off the springs. The leaves of the springs can then be separated sufficiently by driving a thin wedge in at the ends or side, grease to cover the surfaces being applied with a knife blade. The pivots and shackles should also be greased if it is not too much trouble to take them out. Otherwise considerable heavy oil should be poured on each end of the pivot protruding from the socket. A better scheme than pouring oil over them, catching it in a pan and repeating the process, is to immerse the joint in oil by tying a tin can or other convenient receptacle filled with oil on the joint wherever this is possible.

Hauling a Cripple

In the event of a breakdown irremediable upon the road, when recourse must be made to haulage by another motor, or anything that can exert tractive force, care should be taken as to the manner in which the tow rope is attached to the motor wagon. It is by no means advisable to make the tow rope fast to the front axle; it is better to secure it to the projecting ends of the frame, which serve as spring horns, and pass the rope between these and the ends of the springs themselves. The haulage stress is then distributed evenly through the frame to both axles. The ends of the rope so passed should be taken and attached to any suitable part of the haulage equipment. If the motor wagon is to be loaded up on to a horse-drawn vehicle, take care that the wheels of the horse wagon are securely blocked before any attempt is made to run the motor up the inclined planks by which the floor of the horse wagon is to be gained. Be ready also with suitable blocks or rods to scotch the wheels of the motor and arrest it at any part of the ascent if this should prove necessary from any cause whatever.

Driving Over Rough Spots

When about to pass over holes in the road, or short patches of loose stones, the car should have sufficient momentum to carry it over such rough places, so as to allow the clutch to be disengaged. This prevents racking the mechanism.

Hot Bearings

Hot bearings may be the result of lack of lubrication, too close adjustment, or both, and should be carefully watched for, especially when the vehicle is new. Feel the bearings frequently at first, and if any one is found hot, see whether it is getting its proper supply of oil. If it is, but runs hot notwithstanding, ease it a little by slackening the adjustment nuts or screws until it turns freely without lost motion. A little time spent in the adjustment of bearings is a good investment, for lost motion quickly multiplies itself. A bearing that is frequently adjusted will last much longer than one that is only attended to when the wear becomes serious.

A Cheap Gasoline Gauge

A very efficient and cheap form of gasoline gauge can be fashioned from a sufficient length of ground-glass rod which should be fairly stout. Run your wagon on to a level place, empty your tank and then measure the fuel back therein, gallon by gallon. After the introduction of each gallon sound the tank with the ground-glass rod, and the height of the fuel therein will be plainly visible on the rod. Mark the height of each successive gallon on the rod with the edge of a sharp file, and keep the rod handy for use when required.

Overheated Engines

The cause of lost engine power can often be traced to the exhaust valves, though the direct cause of their leakage is sometimes hard to reason out. Driving with a retarded spark and increasing speed with the throttle, which is done very often by the novice, causes the engine to overheat. This overheating causes the exhaust valve to expand, sometimes to such an extent that it rests on top of the tappet which lifts it. The compression, of course, is lost, and to get any speed at all the driver opens the throttle wide. This intensifies the initial trouble, and the valve is burned up in its setting. If the wagon is driven correctly no harm can come from this source.

Sudden Stoppage of the Engine

If the motor suddenly stops, the cause is invariably due to faulty ignition. Look at the battery terminals before testing for leakages or shorts, as a loose connection or, in the case of accumulators, a connection broken off entirely because of corrosion, will effectually prevent any current flow through the wiring.

Proper Tension for Valve Springs

It is absolutely necessary to keep the exhaust springs at the proper tension. If the spring is weak the suction stroke of the engine will suck back a portion of the burnt gases instead of exerting the full suction on the carburetter. If the gases drawn in are hot enough they cause misfiring, and in any case there is a serious loss of power.

Loose Fly Wheel

A loose fly-wheel will cause the most aggravating of knocks, because it will be heard at all speeds. Where the fly-wheel is fastened to the shaft flange by studs, these sometimes work loose, probably due to misfiring or advancing the ignition too quickly. In refastening the loose wheel, bolts and castle nuts should be used instead of studs.

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RURAL MAIL DELIVERY

AT least three of the rural mail routes radiating from Milwaukee will soon be traversed by automobiles, the carriers having become convinced that there is a very decided economy both of time and money to be obtained from using machines instead of horse drawn vehicles.

Until the semi-official announcement was made that the post office authorities had satisfactorily tested a small light vehicle over some very difficult eastern routes, the rural carriers hesitated to believe that they could actually afford to own and operate a machine. The Milwaukee carriers, however, communicated with Washington and found that a motor buckboard costing but $360, could be maintained at such low annual cost as to make its purchase inviting.

It is necessary in a great many cases for the carriers to own at least two horses. As each route averages about twenty-five miles, which is covered every working day in the year, it is customary to use one horse one day and the other the next, or to use one horse one week and the other the following week. Besides the cost of two horses, at least $150, the feed bills represent no inconsiderable item in the expenses of a rural carrier, especially

Postoffice Test of Motor Buckboard.

as the animals must be fed on grain the entire year. This item, in connection with the repairs frequently needed, make the total expense for each carrier high and prevents many from taking the examination and entering the service.

With the small automobile, it has been pointed out, there is no expense for feed and the fuel cost is low. What repairs are necessary are usually not costly for a machine such as has been used by the department in making the experiments, and these facts have caused the department officials, as well as many of the carriers themselves, to view the employment of automobiles with favor.

The one great argument in favor of the adoption of the automobile in rural mail service is the immense

Another Official Test.

saving of time in the delivery of the mails. This is of prime importance to the carrier as well as to the department. Where it usually takes a rural carrier from nine to ten hours to cover his route with a horse, the auto will cover the same route in six hours or less.

This saving in time may be employed by the carrier in carrying on some occupation outside of his governmental duties, thus adding to his income and tending to offset any added expense entailed by the purchase of an automobile.

IDAHO MOTOR BUS LINE

PASSENGER traffic by motor bus has been commenced between Ross and Rathdrum, Idaho. The machine makes four trips each way for the time being, connecting with the Coeur d'Alene & Spokane Railway company's trains at Ross. The bus is a 40 hp. machine with seating accommodations for 14 passengers. Provision will also be made for carrying baggage and express.

The distance from Ross to Rathdrum is a little less than eight miles, and the trip is made in 20 minutes. The Rathdrum Transit company, as the operating company is styled, is backed by F. J. Marvin, E. H. Brownell and J. M. Campbell of Spokane. The company expects that many people will be carried to Rathdrum who have cottages at Spirit, Fish and Sucker lakes.

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Motor Bus Traffic

Police Supervision of the Vehicles Develops Much Instructive Information

MUCH instructive information has been elicited in the course of the parliamentary investigation of motor bus service in London, begun some time ago for the purpose of determining to what extent police supervision should be exercised over these rapidly multiplying machines.

The managing director of the largest operating company testified that the best drivers in his employ were those who, familiar with the streets and roads of the metropolis from long employment in horsed omnibus service, knew absolutely nothing concerning the mechanical construction of the machines they are now guiding. Singularly enough, the mechanics who are employed in the stable of this company are unable to drive, or, if they can do so, show skill far inferior to that of the unmechanical driver. The system of training by which horsed omnibus drivers are converted into motor bus drivers has been described at length in a previous issue of this paper.

Side slip in the opinion of this witness, would rapidly disappear if city streets were kept in a thorough condition of repair and cleanliness. Side slip, he declared, did not occur on wet asphalt when the asphalt was clean.

Much complaint has been heard concerning the speed of motor buses. The law confines their speed to 12 miles per hour. It frequently happens, however, that the spirit of competition overcomes the discretion of drivers and the vehicles are raced against each other, though this dangerous practice is discouraged in every way by the operating companies. To prevent this lawless practice a bonus system has been devised which rewards drivers in proportion to the number of passengers they succeed in picking up on their trips. Racing, therefore, is not to the driver's interest. But it is a difficult practice to uproot, as the natural sporting instinct of the driver is whetted by the rivalry between the operating companies and the camp followers of the concerns which make the many varieties of motor buses seen on the streets.

The average life of a hard worked gasoline motor omnibus, according to the confession of the managing director above quoted, should range from 4 to 5 years. It would be longer if more machines could be had to relieve the pressure of the service. The service, however, is both popular and profitable, as may be inferred from the fact that one big company is pledged to the purchase of $1,750,000 worth of machines before the end of the present year, while all of the companies are committed to the expenditure of almost $2,500,000 for stables and stable equipment. It is the consideration of the enormous present and prospective investment in motor buses which encourages the majority of well informed observers to believe that no harshly restrictive police measures will be adopted to cripple the industry.

It is interesting to know that during the past six months 114 motor buses have been compulsorily removed from the streets of London on account of the excessive noise which they made while in action. This removal was accomplished by the police authorities. Machines removed from the streets for cause are not permitted to be put in service again until the police inspectors are satisfied they are in fit condition for public use.

The daily papers of two continents have recently been voicing public indignation at the noisiness of motor buses. Experts ascribe the noise to three causes; bad road surfaces, the high pressure character of the service and the consequent inability to give the machines adequate repair-shed attention, and careless driving. The popularity of the motor bus compels the companies to put vehicles into service which have not been thoroughly overhauled. The poor condition of the streets causes small parts of the machinery to shake loose. The noisy exhaust from engines is absent from the new type of vehicles now being delivered.

It must not be forgotten in considering the real or imagined structural shortcomings of motor buses that they are in a class by themselves so far as commercial motor vehicles are concerned. Few stop to reflect that these 7-ton machines are operated under conditions of extreme difficulty which are not paralleled in any other branch of commercial motoring. They are public service machines which invite criticism that would be unwarrantable in the case of vehicles employed for the transportation of merchandise. It would, therefore, be unjust to conclude that the criticism of the motor bus can be extended to apply to the commercial motor wagon. The paying load of a motor bus is fixed at 2 tons. There are about six hundred motor buses in London. If six hundred 2-ton merchandise motor vehicles were traversing the streets of any city it is altogether unlikely that they would give rise to any of the many objections which have been urged against the employment of so many public service vehicles.

London Steam Bus.

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BIDS WERE TOO HIGH

THE specifications for a motor police patrol wagon which the Hartford, Conn., authorities drew were of such a radical character that the builders of such vehicles found it practically impossible to construct the machine needed at a cost within the sum voted for its purchase. Four bids were received by the board of contracts and supplies, but all exceeded the appropriation.

The board advertised for bids on a machine to be constructed to the following general specifications: gasoline four cylinder motor of 45 to 50 hp., sliding gear transmission, three speeds and reverse, double chain drive, 34-inch wheels to be fitted with solid rubber tires, front and rear axles of chrome nickel steel, tread of 56 inches, and wheel base sufficiently long for a body seven feet, eight inches in length back of the driver's seat. A speed of from eight to thirty miles on the high gear was specified.

The call for bids was answered by the following:

Manhattan Commercial Company, New York City, agents for Mack Bros., of Allentown, Pa., gasoline vehicle, four cylinder 50 hp., motor, wheel base ten feet, three inches, to be constructed in ten weeks at a cost of $5,800.

Pope Manufacturing Company, Hartford, Conn., four cylinder 45 h. p. motor, solid rubber tires, etc., to be constructed in four months at a cost of $3,500.

Knox Auto Co., Springfield, Mass., after expressing much dissatisfaction with the board's specifications and pointing out the defects of such a machine, bid $3,000 for one of their regular models.

The Knox Truck Company, of Springfield, Mass., also expressed dissatisfaction with the specifications, and offered a regular model at $3,200.

As but $2,600 was at the board's disposal the bids were rejected. An additional appropriation will be asked for, but is not likely to be granted for some time to come. Such a vehicle as is desired by the board is impracticable.

A FLOURISHING INDUSTRY

SOME idea of the magnitude of the motor bus industry in France may be gathered from the fact that the Derracq-Serpollet conjunction of interests, formed some time ago with a capital of $1,000,000 for the manufacture of heavy public service vehicles, has laid out and equipped its factory for the production of one hundred chassis per month.

Two models are being constructed, one of 25 hp. for eight passenger single decked vehicles, such as have been running in France for some time, and a heavier type of 40 hp. with double deck and capable of carrying thirty-six passengers. The success of the smaller type has already been well established. Five of the large vehicles have already been jut in service, and before the close of this month it is expected the factory will be turning out five or six of these large machines each week.

ELECTRIC ICE WAGON

THE Charter Oak Hygeia Ice Company, of Hartford, Conn., employs for the haulage of ice a five-ton electric truck supplied by the General Vehicle Co., of Long Island City. This vehicle was installed on June 28 last. It hauls artificial ice from the company's plant to customers scattered over a radius of four or five miles. The plant is two miles from the center of the city. There are two approaches to the center of the

city, either one of which the truck must use, and in each instance a long hill of about 20 per cent. incline is to be negotiated, but according to Manager Kelsey the vehicle experiences no trouble in climbing the hill under a full load.

In general appearance the body of the vehicle follows closely the lines of the conventional ice wagon, with the exception that it is slightly longer and higher. A full load is carried each trip to the city and the run back to quarters is made light. The truck is one of a series of six machines which are being constructed for the company. The battery is composed of 44 cells supplying current for two motors. The maximum speed under full load is nine miles per hour. The average daily run is about 25 or 30 miles, the limit of the batteries being 40 miles. The wheels are 36 inches fitted with solid rubber seven-inch tires. The batteries are charged in the company's own plant. The truck will haul four times as much as a double horse team and in one half the time.

INTERURBAN BUS LINE

MOTOR bus transportation service is badly needed between Salem and Youngstown, Ohio, now that the project to connect the two points by a trolley line has been abandoned.

It is believed that a line of motor buses can be profitably operated every hour between the terminal points, touching Albany, Gettysburg, Calla, Greenford, Canfield, Cornersburg and Lanterman's Falls. This route covers the original stage line, a distance of 20 miles. A fare of $1 each way is proposed. The plan is to have three machines, each with carrying capacity for twelve passengers, going each way at the same time, the trip consuming an hour.

A motor bus line is operating between Salt Lake City and Saltair Beach.

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GENERAL MOTOR EXPRESS

ANOTHER concern formed to do a general motor delivery business is operating in Syracuse, N. Y., under the name of the Auto Express Company. Two 1,500 pound gasoline wagons, fitted with 10 hp. air cooled Logan engines, are now in commission. A heavy truck, convertible to a sight-seeing machine, and two 2-ton trucks for suburban work have been ordered and will be in service in a short time.

The partners in this enterprise are A. W. Johnston, manager of the Red Line Messenger Service, and Louis J. Lynn, of the Syracuse Trust Co.

Boys formerly employed in messenger service have been trained to act as drivers. The chief business of the company will be delivering merchandise to customers of small stores, the hauling of baggage, etc. The manager has made arrangements with the Auburn & Syracuse railway to take care of the baggage going from that line, also with the St. John's Military school at Manlius. The company has sent out several thousand cards and letters, informing the merchants that they are ready to do business and responses are coming in daily.

RIVAL INTERESTS CONSOLIDATED

FIVE electric trucks and three motor buses, each carrying 24 passengers, are employed by the Oregon Auto-Despatch Company in Portland. The trucks are fitted with electric hoists.

The company's service, commenced a year ago, from the start gave such formidable competition to the largest local draft animal trucking and transfer service that it soon became apparent the two could not survive in the same field. A combination of interests was therefore effected.

Power for the electric machines is supplied from the plant of the Portland General Electric Co. at a cost of 40 to 50 cents per truck per day, depending on the tonnage of the vehicle. Wages paid for reliable drivers are $2.60 to $2.75 per day. In addition to the electric vehicles the company now uses sixty-five horses with wagons and drays. The horses take care of the bulk of suburban business, but as soon as the new organization, which has $65,000 to push its business, grasps the details of the administration problem, many animals will be sold to make room for the more profitable machines.

MOTOR BUS DISASTER

AN eye witness of the disaster which recently befell the excursion motor bus traveling between London and Brighton gives the following vivid, if amateurish, account of the behavior of the machine and its driver as it plunged downhill to destruction:

"On nearing Handcross Hill the bus was going at its usual speed—from twelve to fourteen miles an hour. Immediately we passed the signpost at the head of the road the car rapidly gained speed. I was watching the driver and waiting for the application of the brakes, but he still let the car go on for some two hundred yards. I was about to rap the window to remind him when I saw him reach out and put his hand on a lever. Immediately he did so there was a jar and a loud report. We had gone another thirty yards, when looking behind I saw a large cog and other remnants of the car lying on the road. The driver was trying to steer, but the car kept going from one side to the other. We lurched to the left, then to the right, then to the left again; and the next time we lurched the top of the car caught a tree, which completely pulled the top from the body of the car, and in so doing overpowered the driver. The tree pulled the car round into the bank, and the inside passengers were violently thrown out. The car was running free down hill."

The wrecked bus had traveled 18,030 miles and been inspected by the police quite recently. A special squad of policemen, consisting of 30 men, is detailed to inspect all London motor buses, surprising the drivers while the machines are traveling.

The disaster appears to have been chiefly due to four causes: Collapse of the gear box, falling of the cardanshaft from the front end, agitation among the outside passengers, and excessive camber of the road. Many believe that, had the panic among the passengers not taken place, the accident would not have occurred, as the bus apparently was swayed over to the side, and struck the trunk of the tree.

WASTE OF POWER

A VERY interesting experiment was recently conducted for the purpose of ascertaining if one explosion of a gasoline mixture in a cylinder compression chamber really liberated the full volume of power which it contained.

A metal tube, closed at one end, was fitted with a cork through which a needle was passed, the needle piercing the cork. The high tension terminals of an induction coil having a capacity to bridge a five-inch gap were connected to the tube and needle. This completed the testing apparatus. The smallest possible amount of fuel was put into the tube, by dipping the finger in gasoline and allowing it to evaporate almost entirely and then rubbing the inside walls of the tube with the finger. The cork was blown out upon closing the circuit through the coil. This performance was repeated by replacing the cork and switching on the current, it being ascertained that as many as four explosions, apparently all of the same power, could be obtained from the one minute charge of gasoline. This would appear to demonstrate that a charge of gasoline vapor and air is only partially exploded, and that the combustion of the remainder is prevented by the violence of the explosion itself.

The experiment would seem to indicate that it is not the size of the spark, but its frequency, which determines efficiency. It would further seem that the exhaust at the muffler is still an explosive mixture.

A rural mail carrier in Manchester, Ia., is covering his route in a motor buckboard.

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SUPERIORITY OF POWER WAGON BRAKES

POWER wagon brakes are more effective than the brakes employed on street cars. Going at full speed the heaviest road motor can be brought to a standstill before the machine has traveled much more than its own length. A light street car, on the other hand weighing 14 tons and running at a speed of 18 miles per hour can be stopped only in a distance of 115 feet with an average deceleration of over 2.5 miles per hour per second, the time consumed in bringing the car to rest being slightly more than seven seconds. A heavy interurban car weighing 40 tons can be brought to rest from a speed of 55 miles an hour, at an average deceleration of 2.4 miles per hour per second, during a period of approximately 23 seconds and while covering a distance somewhat under 1,000 feet. This was accomplished with 40 pounds pressure in the air brake cylinder. The performance could be somewhat improved with a higher braking pressure, although this is probably as great an average deceleration as should be employed.

In a tight situation, therefore, it is evident that it would be discretion on the part of a motor wagon driver to make no great allowance for the ability of the operator of a fast moving street car to avoid collision.

MOTOR BUS FRANCHISES

ONE of these days a motor bus franchise will be worth more than it is valued at just now. As an illustration of the value of a well conducted service of this sort take the situation in Ridgewood, N. J., between which point and Patterson the Union Traction Company wishes to be confirmed in its right to operate motor buses for a period of twenty-five years, using the streets of Ridgewood.

The company recently began this service, charging 35 cents for an excursion trip. It is admitted by the company that the venture has been financially successful, and, according to one authority, its net profits have exceeded $100 a day. The company claims a right to run automobiles without permission from the village trustees, because it pays a license fee on its automobiles, which are of the sort used in cities for sight seeing They are heavy and cumbersome, and have done considerable damage to the roads. The company now proposes to extend its service.

It is feared that unless some united action is taken by the citizens the company will secure the franchise gratuitously, and then proceed to use the main thoroughfare of the village.

A $15,000,000 company has been organized in Arizona for the manufacture of a new railway motor car designed for suburban traffic service. The car is an invention of Hugh Matthews, of Kansas City, Mo. It is said that prominent Missouri, Kansas and Texas R. R. officials are associated with him in the organization of the company.

SCANDAL OVER A SALE

MANY experienced buyers of gasoline automobiles, both for business and pleasure, would prefer to purchase a machine which has been handled for a brief time by a careful demonstrator, and has had its engine tuned up and put in thorough running order, rather than break in a new machine. Not so the Dayton, Ohio, board of safety, which recently purchased an agent's demonstrating machine for its fire chief while under the impression that it was a new car.

So far as the efficiency of the machine is concerned it is not known that it was any worse than upon the day it first issued from the shop. Tires and other features of worn equipment were replaced; the body, which was not wracked, was repainted; and the engine, which was carefully examined for signs of deterioration, was passed by the factory inspectors as in perfect condition, more perfect in fact than if it had been merely given the usual service on testing block and road before shipment. The chassis, in short, was proven to be without defects and in a thorough state of repair.

In the advertised proposals it was specified that the machine was to be new and equipped with one tail lamp, two side lamps and necessary equipment. The agent who sold the car agreed to furnish the machine according to the specifications for $1,275. The machine was delivered to the city and collections were made of $199.50 for two extra lamps and other equipment, and $30 for a box on the rear. There was also a top for the machine, for which a charge was made of $100, but this was never paid for, although the top is yet in the hands of the fire department.

Now the gossips assert that the city purchased an automobile that had been run around the streets for some time as a demonstrating car; that the city paid $1,504.50 for a machine which had been offered to it for $1,275.

HACKMEN ARE DISTURBED

WAR has been declared upon the huge sight-seeing automobiles operating in New York by the hack and cab owners, whose business naturally suffers severely through the popularity of the big machine service. The Public Hack Owners Association complains to the chief of the license bureau that the automobiles make illegal use of public cab stands.

The hackmen wish to know the status of the sight-seeing automobile—whether it is a stage or a street car. Decision has not yet been made.

Before the advent of the sight-seeing machine the hack and cab owners were accustomed to expect heavy patronage from visitors to the city. The machine, with its guide and his megaphoned remarks upon the interesting sights which pass in review, has practically siezed that trade and given much better value for less money than the Jehus were wont to extort.

The cab and hack owners desire that the proprietors of the big machines, now plying the streets so numerously, shall be obliged to procure franchises. The desire is not unreasonable.

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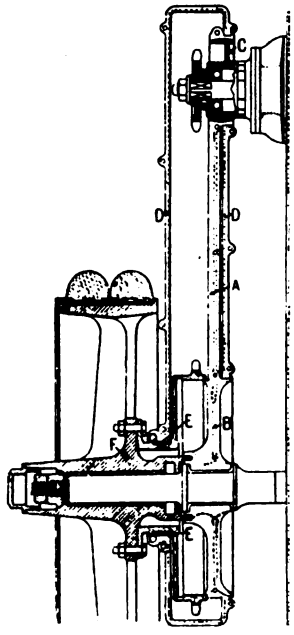
CHAIN COVERING

CHAIN wear is largely due to the presence of dirt and grit. If the chain was enclosed its life would be greatly prolonged. If it ran in a dust proof case it would in all probability outlast the wagon and certainly would do so if it seated correctly on properly cut sprockets of liberal diameter.

The illustration shows a combined chain case and radius rod, the latter forming the back half of the chain case itself. The tension bar A takes the form of a beam, which terminates rearwardly in a disc B concentric with the axle, and carrying the brake mechanism. At its for-



ward end the tension bar encircles an eccentric C, which is rotatable for adjustment of the chain. The chain case D is divided into halves, and is mounted on the eccentric C in front, and on the disc B at the rear, and, consequently moves bodily forwards or backwards according to the chain adjustment. A dust-excluding washer E is arranged as shown to prevent the dust passing in through the bearings to the chain case on the wheel hub F.

IMPORTANT DECISION

AN important court ruling has just been rendered abroad in connection with the skidding of heavy motor vehicles on greasy streets. A motor bus, weighing five tons unloaded and seven tons loaded, collided with a cab and wrecked it. The judge held that as the greasy condition of the street made it impossible to steer the big machine with precision neither the driver nor his employers were responsible for the accident.

MOTOR BUS AND TROLLEY

IN London just now there is a mighty outcry with respect to the motor omnibuses, shortened to "mobuses" by the curt Britisher. The outcry is so persistent, indeed, and it is pitched so significantly on the same key that a certain suspicion is excited as to its origin and purpose. There is at least warrant for the surmise that the traction interests of the British capital, both surface and underground, may have taken alarm at the progress of the "mobus" and are striving to render the vehicle unpopular.

We hear a great deal, at all events, of the drawbacks of the "mobus". It is declared to be noisy and dangerous. High-priced medical experts denounce it. Hygienists condemn it. The "mobus" is the target for no end of reprehension, yet it continues to grow in favor. This latter fact probably explains the onslaught upon it by so many forces, apparently acting in concert.

This may be said with certainty—and it applies to Chicago as well as to London—that, given good pavements, the motor bus will come dangerously near to putting surface traction lines out of business. It enjoys certain advantages that can not be gainsaid.

The "mobus" requires for its operation neither track nor trolley nor third rail. It dispenses with the enormously expensive power house. It eliminates the cost of maintenance and renewal of way. It is a free agent so to speak. If one street be blocked it can take another.

When a trolley line gets into trouble, business ceases throughout its entire length. The same thing happens with a cable line. But the "mobus" is self contained. It proceeds under its own power. Its disability does not affect other "mobuses."

Thus both in the matter of expense and in freedom and facility of operation the motor bus enjoys indisputable advantages over the track-tied car. It is this which is causing the traction managers in London and elsewhere uneasiness. It is uneasiness which is entirely justified.

In Chicago thirty years ago a line of horse-drawn omnibuses compelled the street car people of the west side to sell tickets at the rate of three cents a ride. If the conditions were right in the matter of pavements the same thing could very likely be done today, and even then the street cars would lose a great part of the short-haul traffic.

In the present condition of municipal government in this city good pavements, such as are essential to motor bus operation, are not a probability of the immediate future. But they will come some time and when they do the traction folk will need to gird up their loins and prepare for trouble.

The "mobus" will be upon them just as soon as it finds pavements to run upon.—Chicago Chronicle.

NOVEL ELECTRIC FIRE VEHICLES

BERLIN'S richest suburb, Charlottenburg, is to be protected by four electric fire vehicles—escape, engine, first aid and tackle wagon. The top speed of these machines will be 19 miles per hour. The station in which they will be housed will contain workshop and charging plant. Batteries will be so arranged as to permit removal and replacement even in the street.

Two electric public service vehicles will be operating in Lawrence, Kas., in a short time.

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WALTER WARDROP, EDITOR

Summer Losses

Unreliability of the Horse Abundantly Demonstrated During Recent Heated Period

DURING the recent hot weather many large establishments have had painful occasion to observe the inferiority of draft animals in the transportation of city merchandise. Sun bonnets, carefully selected summer feed, moderate work—none of the favorite prescriptions for equine health have proved effectual. Thousands of horses have perished from the heat.

Of course this was to have been expected. The horse, however tenderly cared for, is a bad risk. If he is worked hard his years of usefulness are inevitably shortened, while if he is worked light his service is unprofitable. In extremes of heat and cold his physical shortcomings are most apparent, for in one case he is easily fatigued and in the other peculiarly susceptible to disease. The power wagon, on the other hand, is neither affected by tropical heat nor arctic cold. It suffers from no lassitude in summer or sensitiveness in winter. Its energy is a fixed quantity throughout the year. It is, in short, a good risk which is made better by the care given to it, but never sinking below an easily determined point.

The demands of business are so urgent nowadays that a merchant who desires his draft animal transportation to be efficiently maintained finds himself without alternative in keeping more horses than he actually requires. This waste is unavoidable so long as dependence is wholly placed in horses. The percentage of "spare" horses is seldom less than twenty-five in an actively operated business where liberal ideas of management prevail. Breweries, for example, find from experience that footsore, run down and disease-stricken animals compel the maintenance of reserves in proportion as mentioned.

Spare power wagons, too, are necessary, but not for the same reason that makes it compulsory to keep more horses than can be actively employed. Motor vehicles need rest, not because they show signs of fatigue, but because their arduous duty cannot be guaranteed constant unless the mechanism is occasionally overhauled. One stable day a month is considered enough for a locomotive which is well tended. It is also enough for a power wagon if the vehicle gets that measure of daily attention which ordinary prudence would dictate it shall receive.

Nothing so cripples the business of a large or small establishment as the interruption of its delivery service. The demand for good horses is so active, and the supply so short, that when a serious breakdown occurs it is well nigh impossible to procure outside assistance to tide over the emergency, and when it happens that such assistance is available the costliness of the borrowed aid is not a matter for pleasant contemplation.

There are a great many large retail establishments throughout the country which, in the highly competitive conditions of business, find it necessary to operate their delivery systems with much precision. The head salesman of one such concern, employing about 75 horses, one day last August found ten of the animals in his care incapacitated by the heat. He took the usual precautions to save their lives, and was congratulating himself upon his apparently successful treatment when seven more were stricken. A hurried call for assistance met with no response. Nearly every stable in the city had its quota of heat affected animals. Nine horses, valued at about $1,800, were written off the books of that establishment. Its delivery service was crippled for four or five days.

A brewery firm in New York, which four years ago timidly experimented with electric wagons, but never rose to the point of appreciating the care which the ve-

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hicles should receive and eventually discarded them, experienced a similar misfortune, ten of its animals dying in one day from the heat.

These fatalities are merely recorded for the purpose of pointing out the unreliability of the horse at the particular season of the year when its service is most needed. The recital is without malice, otherwise we would multiply the instances in which horses have perished in the blazing heat of the summer just spent.

Railway Depot Trucks

Usefulness of Motor Baggage Truck Being Tested by the Pennsylvania Railroad Company

NEW uses are being continually found for the power wagon. It is not alone in the supersession of draft animals that the utility and economy of the vehicle can be demonstrated. We may confidently expect that large numbers of light motor trucks will soon be employed to do the work in factories, railway depots and other places where the use of horses is prohibited and human labor is resorted to as a substitute.

It is quite certain that the railway depot baggage truck will be liberally employed. The Pennsylvania company has built two or three such trucks at its shops in Altoona, which, if the models prove satisfactory, will be duplicated for service at all of the large stations on each division of its great railway system.

At a number of stations along the Pennsylvania system more than sixty hand-drawn trucks are now used to convey baggage and express between the baggage room and the baggage cars of in-coming and out-going trains. A great saving of time and labor can be effected by substituting motor trucks in service of this sort, especially where the baggage and express pieces are hauled any considerable distance.

In this age, when the speed of railroad trains between terminal points is a matter giving rise to the sharpest competition, the unnecessary delay of a few minutes at each station on a long route may easily be responsible for the diverting of much patronage. The Pennsylvania company prides itself upon the promptness with which all of its operations are conducted. The gain in time, therefore, to be secured by the employment of motor baggage trucks represents no small advance in administration.

The selection of electric power for the operation of these trucks has no special significance beyond the fact that it is peculiarly well suited for the work to be performed. The utter absence of risk from fire, the rapidity with which the machines can be put in action, their cleanliness, and their evident inability to add to the cloud of smoke and the obnoxious odors which usually characterize railway depot buildings, were among the deciding factors in considering electricity as a motive power.

It is not at all likely that the projected action of the Pennsylvania company will be devoid of other result than the betterment of its service. Minor though the usefulness of railway station motor trucks may be, it is very evident that their employment will lead to economy. One electric truck of suitable carrying capacity should be able to convey all of the baggage to or from an in-coming or out-going train. Everyone knows how many hand-drawn trucks are required to perform similar service on given occasions. There is a man, and sometimes two men, for each truck, and the load pulled is necessarily limited to their strength.

Doubtless this implied waste in wages has made itself apparent to the economists of the Pennsylvania system. Another advantage of the motor baggage truck is the ease with which it can be manipulated alongside of a baggage car, and moved forward and backward as the load on its platform is increased or decreased.

Little information is available concerning the structural character of these Pennsylvania baggage trucks. The well-known policy of the company—to shield from curious view the nature of all improvements until they are actually applied—prohibits us from knowing whether their load capacity is to be one or two tons, although it is believed that the latter figure is close to the mark. So far as can be ascertained the equipment and general construction of the vehicles is similar to that which is observed in regular commercial motor vehicles seen on the streets, with the exception that the platforms are built high enough to accommodate the floor of railway baggage cars.

Between seven and eight thousand commercial motor vehicles are employed in Great Britain. About 3,000 of these machines are employed in heavy work, carrying two tons and upwards. About the middle of this year, when a census was taken, it was found that 2,698 heavy duty vehicles were registered throughout the kingdom, being an increase of 1,654 in a twelvemonth.

Colored men compose the Overland Steam Coach Company, of Nashville, Tenn. It is their intention to build steam buses.

The delivery service of a large milk company located outside of Paris is accomplished by means of motor wagons fitted with refrigerators.

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Economical Speed

Abuse of the Power in Motor Wagons Leads to Higher Cost of Maintenance than is Necessary

UP to a certain point the speed of a power wagon can be utilized to advantage. If, however, this moderate and economical speed is steadily exceeded the useful life of the machine will be considerably shortened and its maintenance cost will be unexpectedly high.

What, then, is economical speed? The answer will necessarily depend upon the weight and rated load capacity of the vehicle, the tire diameters and the importance attached to speed in the business being served by power wagons. Under ordinary conditions of business sixteen miles an hour would be a decidedly economical rate of travel for a delivery wagon of 500 pound capacity if the frame and body are suitably suspended and the wheels are adequately equipped with rubber tires. A well designed one-ton wagon can with economy travel at 12 miles an hour, a two-ton vehicle at 10 miles an hour, a three-ton machine at 8 miles an hour, and a five-ton machine at 6 miles an hour.

These speeds are so frequently exceeded in practice as to give rise to the apprehension that the whole subject of speed in its relation to the economical transportation of merchandise is sadly misunderstood.

When we recall that the average speed of a two-ton horse-drawn truck, loaded and including stops, does not exceed 2 2-10 miles per hour, it seems absurd to press the superior speed contained in a motor wagon of the same rated capacity to a point so far in excess of the horse-drawn vehicle as to run the risk of almost converting the economy of the machine into a loss. Some motor wagon users operate their vehicles upon the theory that the exercise of the speed function is in itself an economy. Hence, we occasionally find five-ton trucks traveling at a rate of 15 miles an hour simply because they have the power to develop that speed. Abuses of this kind are most frequently observed on the returning empty trips.

Unless an establishment which operates power wagons has such complete control over its drivers as to restrain them from making rash use of the reserve power of their vehicles, it is tolerably certain that whenever occasion offers the top speed will be employed. It is, of course, impossible to design a machine for production in quantities which will have exactly the power required for a given duty. Reserve power, therefore, is a necessity. But its existence should not invite destructive application.

Unless there is some unusual impelling cause which makes high speed desirable, it is not safe to operate a power wagon at a speed more than three times faster than a horse-drawn vehicle of equivalent rated load capacity can be hauled. This rule may not hold good in the case of light delivery wagons, but experience has proven that it is quite liberal when applied to vehicles with a rated capacity of one ton and upwards.

The most noticeable effect of speed in excess of that which is determined to be economical is rapid wear on tires. Excessive speed and overload are the deadly foes of tires. The expense caused by wear on tires of speedy light machines seldom attracts much notice or comment. It is a calculated feature of maintenance. It is different, however, when the tire maintenance of heavy trucks is considered, for then the expense is of very formidable proportions. Excessive speeding of big machines should not be countenanced, since in addition to the expected wear from friction against road surface, there is the loss from impact blows and crushing strains, the force of which is in proportion to the speed. In power wagon accounting tire expense is the heaviest item. It is therefore a matter of the utmost importance to see that the expense is not kept unnecessarily high by negligence or culpability.

A couple of years ago an organization in Detroit formed for the purpose of delivering merchandise by one-ton motor wagons was deluded into believing that speed represented economy. As the vehicles were frequently overloaded, and as the boys who operated them on the road had the sporting blood of youth and did not care to be passed by street cars, it very soon developed that the tire maintenance bill was mounting to unusually large proportions. Reprimanding the drivers somewhat moderated the expense, but it was not until strict orders were issued that speed in excess of 12 miles an hour would be penalized by discharge that control of the situation was obtained. Now the tire maintenance expense is almost thirty per cent less than it was a few years ago. Moreover, general repair bills are much lighter than formerly.

The desire of drivers to stable the machine at the close of the day's work with as little delay as possible is a trait in human character which everybody recognizes. It is preposterous, however, to assume that such a failing must be paid for by the owner of a power wagon. A number of five-ton trucks are now being built which can be speeded up to 15 miles an hour. This speed, however, is not supposed to be exercised when the machine is loaded. Will the drivers of these machines refrain from using the maximum speed when making empty return trips in the evening? If they succumb to the temptation, it is absolutely certain that the durability and efficiency of the vehicles will be materially impaired, for no motor wagon of such capacity can economically be kept upon the road traveling at such speed—at least not without radical improvement in existing design.

The remedy against excessive speed would appear to suggest itself. Firstly, vehicles must be fitted with instruments which will accurately indicate the rate of travel. Next, the driver must be made to understand that the speed possibilities contained within the machine under his control are only to be exerted upon critical occasions, and that failure to be governed accordingly should, and very properly does, constitute cause for dismissal, just as com-

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pelling a horse to unnecessarily exert himself would in draft animal service be regarded as cause for a driver's discharge.

The usefulness of the speed control instrument is not widely recognized—in fact has not been recognized at all. It is true that a few establishments have fitted mileage recording devices to their wagons. But such instruments do not give speed control. It is well that the mileage of a wagon should be known. Strict accounting cannot be kept without such a record. But it is of far more importance to know that power wagons are being operated with maximum profit on the road than that the cost of transportation is so much per ton mile. The cost per ton mile will rise or fall with the abuse or proper use of speed. Plainly, therefore, a speed indicating instrument should be a feature of every wagon's equipment.

Charges for Depreciation

Motives Which Inspire Accountants to Write Off Power Wagon Investment at End of Five Years

OPINION differs widely concerning the allowance which annually should be made for depreciation of power wagons. Some accountants, lacking the experience which close observation of the vehicle in service affords, calculate that it will be worthless at the end of five years and accordingly fix the annual cost of depreciation at 20 per cent of the first cost. Others, more conservative and more familiar with what is transpiring in well administered stables employing motor vehicles, consider 10 per cent enough, and thus indicate that the useful life of a wagon is ten years.

We side with the latter, and under conditions of our own nomination would even extend the period of a machine's serviceability from ten to fifteen years. These conditions are not unreasonable, as they assume no more than intelligent care of the vehicles and the timely expenditure of such moderate sums for repair as may be necessary to keep them actively employed.

After many more years of experience with power wagons than we in this country can boast, it has become an established practice abroad to write off investments in power wagons at the rate of 10 per cent per annum. Moreover, this estimate is by foreign accountants considered liberal, as many instances can be found where motor wagons which have been in service for eight years are still in good condition and rendering economical service.

Unless we admit that American vehicles are inferior to those made in England—and there is no evidence which would justify such a conclusion—we are bound to believe that the maximum life of a motor wagon which is properly looked after both in the stable and on the road will not be short of ten years. We are inclined to think that the custom, countenanced in some quarters, of spreading the cost of a machine over five years is based upon the early experience acquired in their use. Five or six years ago, when batteries and structural equipment generally were far inferior to what they are to-day, an American accountant might have been justified in estimating that the life of a machine would be short. And if he had any hesitation in coming to this conclusion the prevailing ignorance on the whole subject of power wagon construction and use would have impelled him to err at least on the side of caution. To-day, however, engineering design is so greatly improved that it is manifestly absurd to apply the same method of accounting which prevailed when the machine was in a cosmic condition. If certain work and administrative conditions are guaranteed, few manufacturers would hesitate to guarantee the durability of their product for ten years or more.

It is, of course, as every operator of a gasoline motor vehicle well knows, easily possible to wreck it in a minute, and that without extraordinary accident of any kind. The English bus tragedy, set forth at length in these pages, some time ago, eloquently testifies to the truth of this assertion.

Certain conditions are absolutely necessary, however, if the life of a machine is to be prolonged beyond the limits set by accountants of the short term school. The rate of travel, for example, must be neither excessive nor injurious. Vehicles must be especially selected with relation to the service expected of them; that is to say, a one-ton machine must not be employed for work which a machine of half the rated load capacity can just as well perform, and vice versa. The care which the machine receives must always be of an intelligent order, and not merely the best which chance affords. Then, too, there must be regular days for overhauling. In short, everything possible must be done to maintain the efficiency of the wagon and keep that efficiency at maximum.

We are now assuming, of course, that the service in which motor wagons are employed is not of the high pressure variety, where money can be made by quickly wearing out the vehicles. Repairs and depreciation, too, must be regarded as one item in accounting, as money expended for repairs prolongs the life of a wagon.

In a previous number we had occasion to show why the charge for depreciation on the electrical equipment of an electric vehicle should be less than on the remainder of the structure. The motor, it was pointed out, did not suffer from use in the same degree as the rest of the machine, while the battery, being regarded as slow fuel, should not be considered in the depreciation account at all. The deterioration of the gasoline vehicle must be regarded as total. There will inevitably come a time when few, if any, of its working parts will

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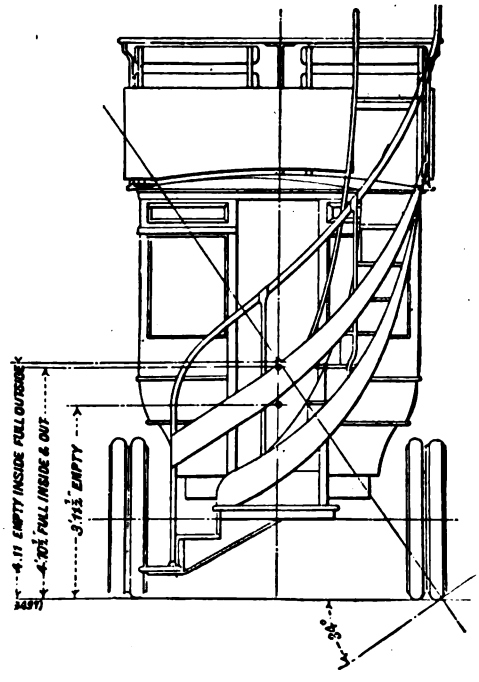
be of the slightest value. When this period is encountered in an electric machine its electrical equipment at least may be saved from the scrap heap and put to service in a new vehicle. About 20 per cent of the total cost of an electric machine is represented by the motive equipment.

But perhaps the motive which inspires accountants to write off power wagon investment within five years is not due to a desire to assign definite limits to the life of the vehicles, but is merely a recognition of their money earning power. Motor wagons pay for themselves within five years. After they have done so, there cannot be much advantage in carrying them on the books.

TOP HEAVY MACHINES

WHATEVER commercial advantage may exist in double-decked motor bus construction it is to be doubted if it overbalances the mechanical disadvantages of such construction.

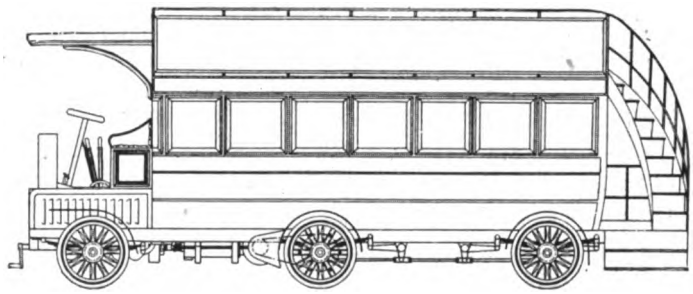
The high center of gravity in a double-decked bus, loaded or empty, undeniably forces constructors to make more ample provision against the severe stresses to which the vehicle is subject than would otherwise be necessary. Such precautions usually result in heavily increasing the dead weight of the machine, which in turn adds greatly to its cost of maintenance. As, however, single-decked buses earn less than double-deckers in cities where this class of passenger transportation has been actively developed it is unlikely that operating companies will seriously consider their employment in large numbers much before the time when it is demonstrated that earning capacity and profitable investment are not necessarily interchangeable terms. One of these days it will probably be discovered that the same rule which governs the operation of motor buses also bears upon the operation of motor wagons, namely, that maintenance costs are largely dependent upon the suitability of the machines to the particular service in which they are employed.



The accompanying diagram is interesting on account of the difference it discloses between the centers of gravity of a loaded double-decked motor bus and one unloaded. It represents one of the latest foreign models. With the bus empty, the center of gravity is 47 1-2 inches from the ground. When the bus is loaded inside and outside the center of gravity is 58 1-2 inches from the ground. When it is full outside, but empty inside, the center of gravity is 59 inches from the ground. This latter is the most serious condition, and unfortunately is not uncommon in the seasons when motor bus traffic is most popular. It, however, would require a deviation from the vertical of 34 degrees before the machine would capsize, which is some comfort for those who are made timid by the swaying of the vehicle when it is under way.

SIX WHEEL MOTOR BUS

VIBRATION and side-slip are the two principal counts upon which dispassionate critics indict the motor bus. Until roads are made for motor vehicles, however, neither can be abolished, although many engineers believe that the evils complained of might be palliated if six-wheel vehicles were used instead of machines running on four wheels.



The executives of the leading operating motor bus companies abroad are well aware of the possibilities, commercial as well as mechanical, latent in the six-wheel vehicle.

MOTOR WRECK WAGON

A VALUABLE addition to the rolling stock of the Capital Traction Co. of Washington, D. C., is the electric wreck wagon just placed in the hands of the roadmaster by the Studebaker Automobile Co., of South Bend, Ind. This machine is supplied with all the tools and equipment usually found in horse-drawn street railway vehicles employed in emergency work, making up a load of 1,800 pounds and carrying a crew of four men, including the operator. The wagon is equipped with 48 cells of battery. It has a speed of 12 miles per hour. The service will be the ordinary emergency repair work. The machine has taken the place of a horse drawn wagon which was kept hooked up at all hours of the day and night. Since putting it into use the company has been able to divert five horses to other work, which heretofore were used entirely for this service.

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Disappointed Investors

Concerns Which Discarded Power Wagons Now Find Their Horses Are Exceedingly Slow

A FEW firms are restrained from buying power wagons because of the belief, extending no further than the walls of their own premises, that in doing so they would be playing the part of pioneers. Here and there a few concerns, which were among the earliest to make use of machines, are discovered to have discarded them and reverted to the use of horses. Those comprising the first group, having gossiped with their neighbors in the second group, chuckle to think how crafty they have been in letting the other fellow do the experimenting. Both are victims of delusion.

In not a single instance yet reported where power wagons have been discarded has it failed to happen that the administrators of the establishments, when they possessed any acumen, perceived as one of the first results of the change the extraordinary superiority of power wagons over horse-drawn vehicles where both were actively employed. Although this superiority is always in evidence it did not strike these deserters of the cause with any particular degree of force until they involuntarily found themselves conplaining that their horses were singularly slow and inefficient. No other result could have been expected in an establishment which once employed motor vehicles.

Whatever regrets they may entertain on this score, however, are of comparative unimportance alongside of the fact that they have not yet discovered the real cause which led them to abandon the machines, and which, contrary to their understanding, is not due to imperfection in vehicles, but to their own inability to administer their work and keep them in commission.

It will not be disputed, if 95 per cent of a given number of people continue to operate motor vehicles with profit, and 5 per cent fail in the attempt, that the mass of people should pay little attention to the outcries and lamentations of the minority. Concerns which have discarded power wagons for one reason or another—and there are precious few who have done so—find themselves so heavily outvoted as to make their own experience utterly worthless.

Probably as time goes on, and the few concerns which in their rashness concluded that the power wagon, demonstrated economical in so many services, is not to be relied upon in the transportation of merchandise, realize that their competitors almost without exception differ in opinion with them upon so important a matter, they will have opportunity to calculate how much money they have actually lost by failing to take advantage of the opportunity thus early presented. It is a striking fact that other firms employing identically the same machines which the deserting concerns have discarded, have for some years past been adding to their stable equipment, thus fairly implying that the vehicles are all the time earning their cost. It is hardly necessary to remark that establishments which are increasing their investments in power wagon equipment are not easily discouraged when unfamiliar difficulties are encountered, but resolutely set to work to overcome them.

It is one of the gratifying facts in the history of the power wagon movement that in every case where the stable administration has been in capable hands, the number of vehicles never diminishes, but, on the contrary, where there is opportunity is always being augmented. The conquering progress of the power wagon is not in the least hindered by the malign or embittered utterances of the unfortunates who have failed to secure satisfactory results without a corresponding expenditure of tact and ability.

Even today, when thousands of machines are in use everywhere throughout the country, the experience of each firm using them differs to a surprising extent. This need not excite surprise. It is merely the expression of the personal equation. Though rules are prescribed for commercial conduct all do not observe them alike. In some establishments, the conduct of the department of transportation is as critically studied as any of the most important; in others, and in too many, it is neglected.

Two motor bus lines in southwestern Oklahoma are well patronized. One line, established last month, makes a round trip daily between Hobart and Glen Springs. At Tulsa machines are doing temporary duty until the street car line, now under construction, is finished.

Two rural mail carriers, whose routes radiate from New Paris, Ind., are covering their districts in motor buckboards.

Senor Ernesto Mora of the Banco de Jalisco, Guadalajara, Mexico, is organizing a company to furnish motor bus transportation between Guadalajara and Chapala, one of the most popular pleasure resorts in Mexico.

The seven miles separating Marinette and Peshtigo, Wis., is now covered by motor buses, which will soon be operating on a fifteen minute schedule. The machines have carrying capacity for 15 passengers. The trips require 30 minutes, including stops. The fare is twenty cents.

A twelve passenger bus is plying between Columbia and Mt. Pleasant, Tenn. The machine makes two trips each day.

The Cape Town, South Africa, street railway company is about to establish a motor bus service, making it complementary to its present rail service.

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Vanity Gets a Setback

Users of Power Wagons Abroad Clash With National Automobile Club Over Trials

A FEW months ago, when it was announced that an automobile club with pretentions to national influence was considering the conduct of public trials for power wagons, everybody wondered by virtue of what right, privilege, or experience it "butted in" and sought to usurp functions which only experts in motor vehicle transportation could hope to exercise.

The history of the club's activities does not greatly encourage the hope that it could block out conditions under which all motor wagons, whether operated by gasoline, electricity or steam, would have an equal chance to demonstrate their merits in competition. The subtle problems which lie back of the mere operation of a vehicle on road or street are not solved, defined or even suggested by any such perfunctory exercises as the club, in its ignorance of the whole subject of power wagon merchandise transportation, would be likely to conduct.

Nobody cares two straws about witnessing "trials" which only demonstrate that fifty or a hundred machines can travel fifty or a hundred miles a day for a week, with loads nicely adjusted to carrying capacity and the vehicles operated by factory experts who nurse and coddle them by every ingenious art known to experienced drivers.

What motor wagon drivers chiefly desire to know is how much it costs to operate the vehicles under the varying conditions of actual service. Trials don't inform them—at least not such trials as an automobile club, knowing nothing of the mysteries of power wagon practice, might be expected to formulate.

Lest it should appear that we are protesting to no purpose in this matter we will, as briefly as possible, set forth the unhappy condition of affairs which has arisen in England as a result of a dispute concerning the qualifications necessary for those who would define the rules under which power wagons can be publicly, though not necessarily decisively, tested.

The first practical tests for power wagons of which the world at large has any cognizance were conducted six or seven years ago by the Liverpool Self-Propelled Traffic Association, an organization composed exclusively of merchants using motor wagons of the period. The results of these tests comprise one of the most interesting chapters in the development of minor transportation, many of the conclusions then formed constituting the broad base upon which subsequent developments in engineering practice rested.

A few years later the Automobile Club of Great Britain, inspired by the marked success of these trials, and being somewhat swollen with the influence which it had gained from the conduct of trials for motor driven pleasure vehicles, concluded to extend its control so as to include competitive tests of power wagons. For one reason and another the Self-Propelled Traffic Association did not desire to dispute control of the situation. Unfortunately the Motor Wagon Users' Association—now easily the most numerous and influential body representing power wagon activities in England—was not yet organized, so that the automobile club had little difficulty in seizing the power its ambition coveted. Soon after the Self-Propelled Traffic Association ceased to be virile, the automobile club, falling heir to its duties, proceeded to conduct trials which, as might have been expected, did not in the least enlighten those who desired to make use of commercial machines, or in the slightest degree establish the fact that those who were already using them were profiting by their employment.

At length the Motor Wagon Users' Association came into existence. Its membership is now upwards of three thousand. Every large concern in England using machines for the transportation of merchandise is proud to belong to the organization, so useful has been its work and so profitable are its discussions. Naturally such an organization could not overlook the delinquencies of the automobile club in its crude attempts to establish the value of power wagon trials, and as tests of this kind were arranged to take place next February the association politely informed the automobile club that before any of its members would consent to participate it would first be necessary for the association to formulate the rules under which the tests would be held.

As a preliminary to subsequent joint action it was proposed by the association that the trials should be confined exclusively to actual commercial work and not, as heretofore, be mere displays in which vehicles carried bags of sand over measured courses and failed to encounter any of the common difficulties of regular commercial service.

In this emergency the pride of the club proved too great. Its executive committee voted to refuse permission for the proposed contest, whereupon the Motor Wagon Users' Association decided that the sanction of the club was not necessary for the trials, and at last accounts was prepared to make shift without the patronage or influence of the club.

Few will question the wisdom of the decision of the association, as it is plain that no self respecting body of business men could permit itself to be used as an advertisement for an institution whose functions are outside of and unrepresentative of that body's objects. However willing the association might have been to support the principle of a central authority on automobile matters generally, that willingness should not be exploited.

The Automobile Club of Great Britain is not a whit more capable to administer public trials of power wagons than the Automobile Club of America. Both organizations utterly lack the experience to make trials profitable to interested observers; both are essentially sporting bodies; both have shown gross incompetence in the conduct of such trials of pleasure vehicles as are legitimately within their sphere of dominion.

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As soon as it became apparent that tyranical rule was what the Automobile Club of Great Britain desired, rather than the furtherance of the economic principles underlying the use of the power wagon, the chairman of the Motor Wagon Users' Association addressed the following communication to its members:

Dear Sir:—A somewhat grave situation has arisen between this Association and the Automobile Club in regard to the contemplated commercial motor vehicle trials. In April last I wrote to the Automobile Club urging that there should be no further delay over the long-promised trials, and offering the assistance of this Association. The Club referred the matter of the trials to its technical committee, and a joint-committee composed of members of that technical committee and members of the committee of this Association, was eventually formed. A program of trials and rules was then drawn up by this joint-committee, and your representatives on that committee were fortunate enough to be able to arrange for the co-operation of two very large users—Messrs. Carter, Paterson and Co., and Messrs. Pickfords—who agreed to test, under service conditions a certain number of competing vehicles, for a sufficiently long period to prove their durability in regular work.

When the rules were printed in draft form and ready for approval, the chairman of the Automobile Club wrote to the chairman of its technical committee stating that the trials could in no event be carried out by a joint-committee of the Automobile Club and this Association, and the practical result of this was that the chairman of the automobile Club, while quite ready to accept the assistance and support of your committee, wished its effective share in these trials, which are obviously of such vital interest to members, to end with the preparation of the rules. In the hope of providing a solution which might be acceptable to all parties, and as proof of the conciliatory attitude which this Association desired to adopt to support the authority of the Automobile Club, a written application was made to the club for a permit to allow this Association to conduct the trials itself under the competition rules of the Club, but the club committee refused to grant this permit.

The position in which your representatives on the committee of this Association were thus placed was held by them to be one in which they could not in any way look after and protect the interests of users of commercial motors, and as Messrs. Carter, Paterson and Company and Messrs. Pickfords stated that their offers would not hold good unless at least half representation on any trials committee was accorded to this Association, I, after consulting and obtaining a unanimous vote of your committee, was instructed to inform the chairman of the Automobile Club that the only terms on which this Association could co-operate in the trials were in accordance with the following clause, which was to be printed on the front page of the regulations:—

"The following regulations have been prepared by a joint-committee of the Automobile Club and the Motor Van, Wagon, and Omnibus Users' Association, and the trials will be conducted by a joint-committee composed of equal numbers of the committee of both sides."

This was refused by the chairman of the Automobile Club, who stated that a joint-committee to conduct the trials was out of the question.

I send you this letter in order that I may learn whether the course that has been adopted by the committee of this Association meets with your approval, and whether you think we should take steps to carry out commercial motor trials on our own account, independently of the Automobile Club. I should also value your views as to whether this Association gains by any connection with the Automobile Club of Great Britain and Ireland in matters which exclusively concern business vehicles.

(Signed) R. E. B. Crompton,
Chairman, M. V. W. O. U. A.

It is confirmatory of this paper's opinion concerning the value of trials that the Motor Wagon Users' Association regards such contests merely as contributory proof of the durability of power wagons in regular work. The association members, all concerns of wide experience, entertain not the slightest hope of proving the economy of the machines in such trials. They know but too well that economy can only be substantiated by actual service, and that its measure is great or small as ability in administration is high or low.

Is it necessary to add that every member of the Motor Wagon Users' Association approved the action of its president and gave assurances that no encouragement would be lent to any body undertaking to conduct trials not governed by rules formulated by the association? By letter and interview many of the most prominent members of the association have pronounced the automobile club unfit to conduct such trials, pointing to its past achievements in this field as evidence of its incompetence and grossly inadequate conception of what is called for in order to make them worth while.

It is easy to see which way the wind is blowing. Trials of the future will be, as this paper has frequently contended, trials in actual service. They will be conducted by people who are competent to establish the value of the power wagon. They will be as nearly decisive in results as it is possible to make them.

MOTOR MAIL WAGONS

THE announcement that the government has decided to have the mail delivered to and from the sub-stations here by motor car is gratifying. The general impression has been that most of the mail has been delivered in ice wagons drawn by superannuated plugs that were candidates for clemency on the part of the Humane Society. If there is anything under the sun that will accelerate the rapidity with which the mail is distributed, Kansas City wants it. The old ramshackle shed that has blurred the Grand avenue landscape for all too long is about to disappear. It is eminently fitting that it should be succeeded by something that belongs to the present century, for the only good purpose it served was to link the present with the immemorial past.—*Kansas City Journal.*

The Aurora, Elgin & Chicago Railway Co. has just contracted for two large automobile trucks which will be used in conveying package freight in the neighborhood of Aurora, Ill. The company will undertake the express business in a modest way and develop it as fast as it can.

Motor omnibuses are operating in San Francisco between the ferry and stations in the Western Addition and the Mission.

The sum of $12,000 has been subscribed to operate a motor bus line through a populous district outside of Evansville, Ind. The route is twelve miles long. Two machines will make hourly trips.

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Correspondence

The editor invites correspondence on all subjects connected with the use or design of power wagons. No responsibility, however, is accepted for the views expressed by correspondents. No letters from firms engaged in any branch of the power wagon industry, which may be regarded as mere advertisements of their products, will be published. However, as many of the most practical suggestions come from those engaged in the industry, their communications upon matters of general interest will be especially welcome.

Functions of the Driver

To the Editor—I was much interested in the remarks contained in your September issue concerning the functions of drivers of power wagons. I am not, however, a believer in locking up the engine and employing men as drivers who know little or nothing about machinery. Such a practice may attract metropolitan users of motor vehicles, since they can command the expert services of garage men in their own employ, or upon occasion summon to their aid the local commercial representatives of the establishment from which the machine was purchased. It may also appeal to motor wagon users in large towns where the same facilities are extended. But in small towns it could only result in more trouble than it is intended to avoid, as in case of an interruption to service the owner would be compelled to wait for assistance that was not immediately forthcoming.

I employ three power wagons, and it is my experience that each of my drivers manifest the keenest rivalry in effecting repairs and adjustments or in overcoming any road difficulty. These operators were formerly engaged as street car motormen. They are not automatons, I can assure you. Nor do I believe they are unrepresentative of American labor.

To me it seems absurd to put dunces or idiots in charge of motor vehicles. Even if the engine was sealed and guaranteed in its efficiency it would require an intelligent driver to get the greatest service out of tires, axles, steering gear, wheels, springs, frame and other parts which are subject to wear and derangement. I therefore favor the employment of drivers who possess accomplishments which will qualify them to efficiently care for the machines they operate.

I further contend that it is the duty of all power wagon users to become responsible for the skill of their drivers. Owners should not expect skilled drivers to drop from heaven. They should take pains to train them. But before this can be done there must be the competency to teach. All the ignorance is not on the side of the driver.

EMPLOYER

* * *

Who Should Conduct Public Trials

To the Editor—Public trials intended to demonstrate the economy, reliability or durability of commercial motor vehicles should not be conducted by automobile clubs, which more and more are becoming organizations for the advancement of social interests. Neither should they be conducted by members of the trade.

In my opinion such trials should be under the governance of a trade association.

I do not favor public trials of commercial motor vehicles if they must be held under the same conditions and with the same management as heretofore. Past exhibitions have shown a lamentable lack of understanding on the part of the promoters as to what the public want to know.

I should not be disposed to enter any public trials unless they were so conducted as to actually establish the reliability, efficiency, economy and durability of the motor vehicle. If, however, these were to be demonstrated I most certainly think that public trials would be advantageous. I can see no reason why they should not be held in a way to insure these results.

JAMES MACNAUGHTAN.

Matters Not Determined by Public Trials

To the Editor—We do not have much faith in the good that public trials of commercial motor vehicles are supposed to do. The buyers of motor wagons are not as susceptible to public opinion and general praise as the buyers of pleasure cars. Investigation of the former is carried out along much more business-like lines. It is generally true that buyers do not base their selection on what they hear, but rather prefer to have a personal investigation of their own and get direct proof by actual trials applied to their own business requirements.

While public trials undoubtedly direct the attention of prospective buyers toward power wagons in connection with their own business, yet we do not believe they convince such people of the reliability of the machines. Nor do we believe that trials demonstrate reliability. The only test that does accomplish this result is actual service in business. Public trials most certainly do not determine the economy or measure the durability of motor wagons, for the most economical wagon in a test of this kind might very easily in the end turn out to be the most expensive when used in actual service.

MITCHELL MOTOR CAR CO.

* * *

The Nigger in the Woodpile

To the Editor—It is amusing to observe the space given by the daily press, and even by journals of scientific character, to the objections to motor buses in London. It reminds me of the absurd objections raised to Stephenson's proposed use of the locomotive for passenger transportation. "The smoke and dirt will annoy everybody on the line; the noise of the machine will scare cows so badly that their lacteal functions will be arrested; if the cows get on the track how will the engine get out of the way?" These are specimens of the cavillings of that early period of railroading. A learned decision ended with this: "If the noise of the engine disturbs the cattle grazing in the lands adjacent to the wagon way so as to injure them with regard to their feeding, I think it may be considered a nuisance."

As suggested by the Chicago Chronicle, the onslaught upon the motor bus is urged by traction interests—they are the cattle of this age and are afraid their functions will be arrested by the progressive modern car propelled by a motor.

T. A. JOHNSON.

It is reported that the Austrian post office authorities have decided to introduce motor cars for the delivery of letters throughout the Empire. This will involve a purchase, in the first instance, of some 800 vehicles.

The councilmen of Everett, Wash., are favorably impressed with the economy and advantages of the gasoline motor fire engine, having already taken steps to purchase one.

Motor buses in Paris earn $40 a day on an average. The average daily earnings of horse drawn buses in the same city amounts to no more than $16.

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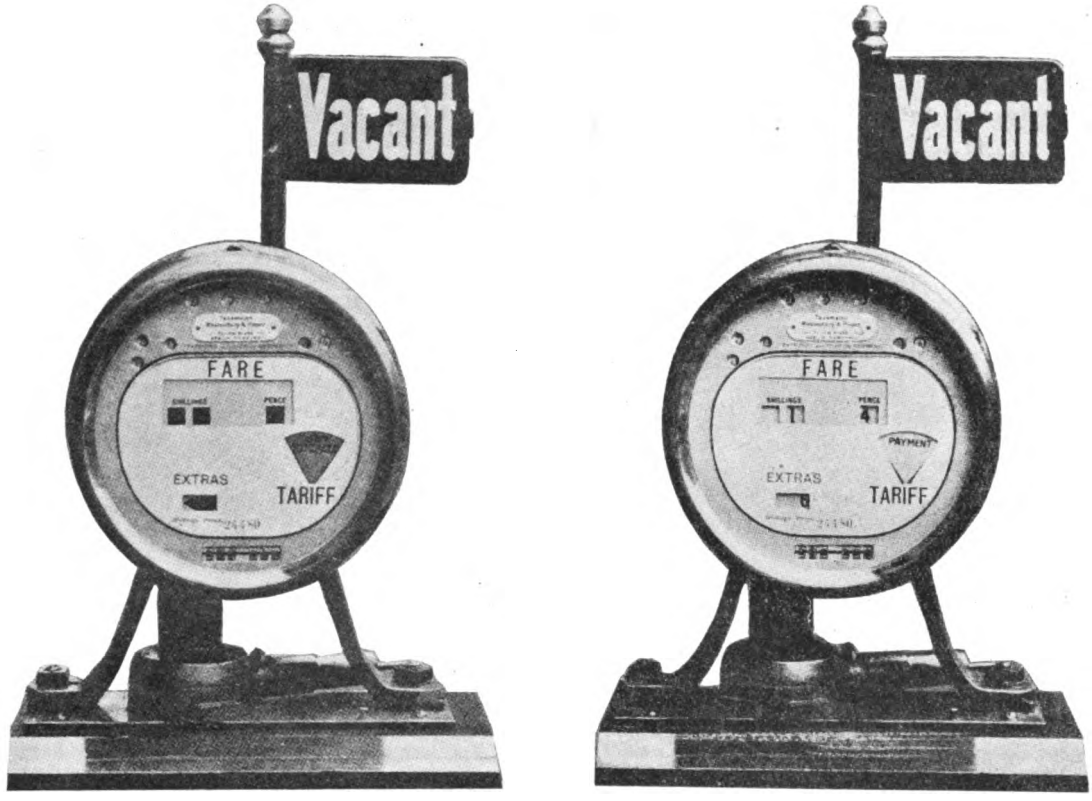

Recording Spaces Covered; Ready For a Fare. Driver Turns a Handle and Fare Due is Recorded.

Value of the Taximeter

By Using the Instrument Motor Cab Owners Obtain Control Formerly Wanting

OTHERS than the passengers who ride in public service motor cabs have good cause for being thankful to the inventors of the ingenious device known as the taximeter. The cab proprietor, once he has had experience with the reliability of the instrument, finds that it is indispensable in establishing close harmony between himself and his operatives. He gets a discipline in the administration of his affairs which formerly was wanting.

Aside from the fact that the work of the vehicle is precisely indicated and its earnings accurately computed by the taximeter, the owner is in position to exercise thorough control over the driver, the history of each day's work being epitomized in the registration of fares and mileage. The growing use of long-distance motor cabs makes administrative control of this kind all the more desirable.

It is 18 years since the introduction of a really serviceable taximeter was made in Berlin. Since then the system has greatly developed, until today it is in use in over eighty cities and towns on the continent, and has brought a distinct and valuable advantage to the cab trade and the public wherever it has been established. In Berlin the system has been made compulsory. Its presence on hundreds of motor cabs in Paris, Berlin and other European cities gives encouragement to the hope that it will soon be a feature of similar vehicles in this country. New York, Chicago, Philadelphia and Boston have heard of it and will likely make it compulsory for cabs of all degrees to be equipped with the instrument.

Undeniably the taximeter holds the balance in a perfectly even manner between cab driver, proprietor and the public. With its cheap initial fares and its low units of increase, coupled with a simple tariff, easily understood by the passenger, it has made cab riding an unmixed blessing.

While driving, the taximeter is worked by one of the carriage wheels and while waiting it is driven by clockwork, but its operations can clearly be seen by a seated passenger throughout. The apparatus can be attached to any vehicle, and can be adjusted or detached in a few minutes. For fitting to wheels of different types, gear mechanism, contained in a special case, is provided, but the apparatus itself is entirely independent of the circumference of the carriage wheel. The taximeter is enclosed in a metal case and completely protected against damp or dust. Its mechanism is inaccessible to incompetent or unauthorized persons. The apparatus shown in our illustration is that which has met with such general success all over the continent, and which has now been adapted to meet the wants of the cab trade in London.

The driver sets it in motion by means of a handle at the back. This handle is connected with a pivoted signal arm, which is in the form of a red metal flag displaying the word "vacant," visible at a considerable dis-

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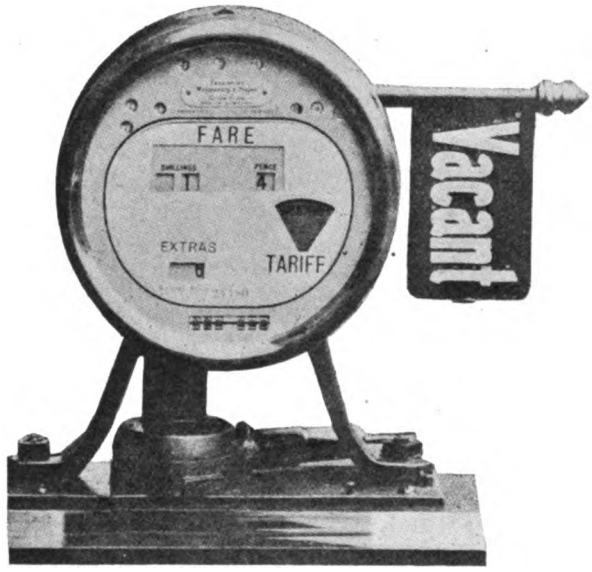
tance. Owing to the automatic locking action between the signal arm and the handle, it is impossible to throw the taximeter mechanism out of gear without previous erection of the signal, and the mechanism cannot be restarted without, at the same time, lowering the signal. The only part within the uninterrupted control of the driver is the registering of the extra baggage or extra passengers. On turning a knob at the back the driver registers these, but this is only possible, however, after the apparatus has been set in motion.

In London it is proposed to have two tariffs—one for outside and another for inside the radius. This is provided for by simply turning the handle again, the driver causing the apparatus to register at the higher rate. The



Signal Arm Depressed.

tariff-changing device influences the indicating mechanism in such a manner that, the higher the tariff, the indicating mechanism is advanced in proportion, and, therefore, the higher the fare displayed. The fare, however, is only affected by the higher tariff during the drive, and not while waiting. When the vehicle stops the clockwork takes up the tale and to ensure that the passenger has a speedy completion of his journey the taximeter is so constructed that, if the carriage proceeds more slowly than the legal limit the clockwork, which is continually in motion, will increase the fare in just ratio.

Besides the indicator for the passenger, there is a register for the cab proprietor, which enables him to control the daily receipts of the driver, the receipts under the heading "extras," the number of engagements, and the total number of miles covered by the vehicle.

The annual expense of hiring a taximeter is about $40 per annum per vehicle.

After a year's experience with motor omnibuses, one of the largest concerns in London which, though employing a great many machines, is still compelled to operate some of its horse-drawn buses, found that its yard expenses has been reduced $9,480, while its maintenance expenses had been reduced $90,192.

MOTOR CAB FARES

MUCH indignation has been aroused among the owners of motor cabs in Berlin by the town council declining to permit a higher rate to be charged for taximeter motor vehicle service than for horse cabs.

It was proposed that the following fares should be changed: Horse cabs, 70 pfennigs for 800 meters, 10 pfennigs for every additional 400 meters; benzine or alcohol cabs, 70 pfennigs for 300 meters, 10 pfennigs for every additional 300 meters; electric cabs, 80 pfennigs for 600 meters, 10 pfennigs for every additional 300 meters.

The proposal was not accepted and so in future the fare for cabs of all kinds will be 50 pfennigs for the first 800 metres and 10 pfennigs for every additional 400. This tariff is for two persons. The council would not increase the fares for electric cabs, which are run on a two-person basis of 80 pfennigs for the first 800 metres and 10 pfennigs for every additional 400 metres. For waiting, the tariffs are 1.50, 2 and 3 marks per hour for horse, internal-combustion, and electric cabs, respectively.

SPECIAL ARMY REPAIR WAGON

WHO wants to build a motor repair wagon for the ordnance department of the army, fitted with a 30 hp. air-cooled engine, with fuel and lubricating oil supply for a 300-mile run, six-inch iron or wood tires, maximum speed of 12 miles an hour and weighing not more than 4,500 pounds unloaded nor more than 8,000 pounds loaded?

The department stands ready to buy such a machine without the formality of bids. Other features to be incorporated in the wagon are: it must be of standard gauge—56 1-2 inches; be able to run on railroad tracks and follow artillery anywhere, have superior hill-climbing capacity and an ability to extricate itself from mud wallows by connecting its power plant to an immoveable object. The vehicle is to transport all tools necessary for the smith, the wheelwright and the harness maker in addition to a small lathe, a grinding machine, a drill press and a forge. If used as a tractor the vehicle must be able to pull a four-ton load over roads which ordinarily require the use of eight horses. Rear wheels must be 48 inches in diameter and front wheels 40 inches.

A PECULIAR FIRE

THE flooding of a carbureter recently led to a fire which completely destroyed a motor bus. Ignition on this machine was obtained by means of a high tension magneto placed on a platform close to the carbureter. It is believed that an extra hot "short" caused the escaping gasoline fumes from the carbureter to ignite. Placing the magneto on the other side of the machine would have prevented such a disaster.

The municipal electric ambulances employed in London may be called from any one of fifty stations which are distributed over the city and resemble fire alarm pillars.

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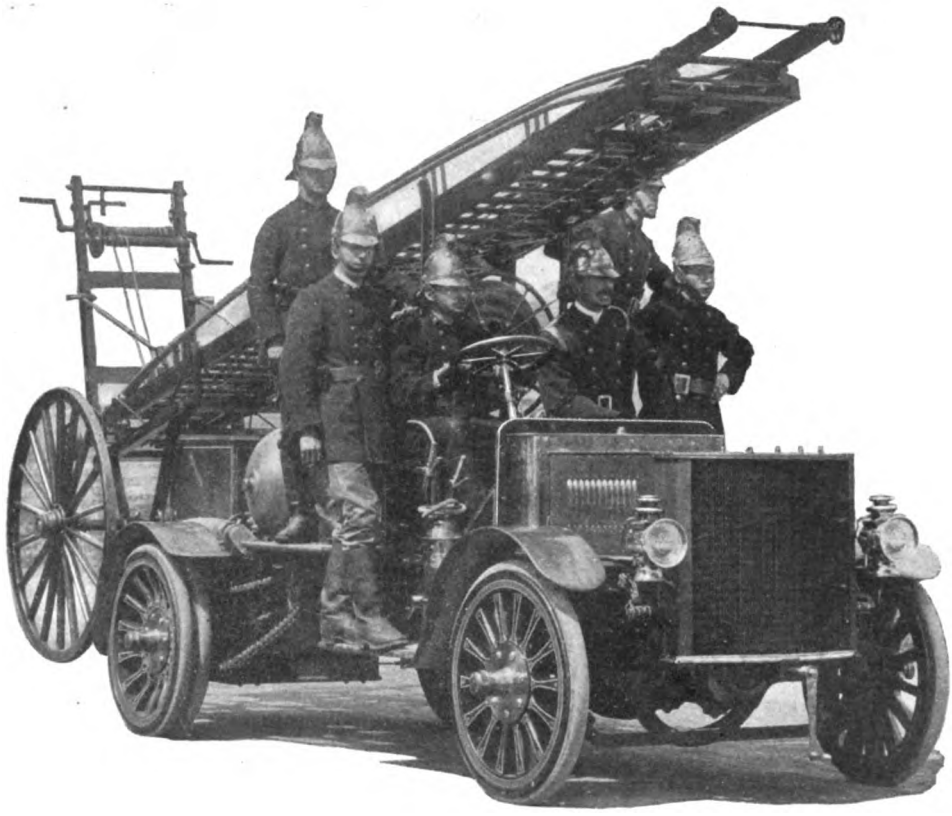

Gasoline Motor Fire Escape Used in England.

Modern Fire Vehicles

Slow Horse Drawn Apparatus Being Rapidly Superseded by Motor Driven Machines

WE have taken the oil fired steam motor fire engine as the basis of our calculations because it is the oldest type of motor fire engine and, generally speaking, the most expensive. Other types of motor fire-engines are driven by electrical motors on the road wheels, but by steam for the pumps; by gasoline motor for both road wheels and pump; and by gasoline or electric motor drive to the road wheels, but steam engine for the pump. The total outlay on a motor fire-engine will amount in ten years, exclusive of the cost of actual operation at fires, to:

Cost of Operating Motors

Original cost of 500 gallon steam motor..	$6,000
Ten years' maintenance	16,060
	$22,060

The extra efficiency for fire-fighting by motor costs $61 per year on the foregoing basis. This small figure, however, is turned into an actual gain financially as well as in fire-fighting efficiency if it is considered that although we have not given the motor the benefit of any economy in operation charges, there is the saving of men's time at the fire, time which, as we have already mentioned, would with horsed vehicles be wasted in watching the animals or taking them home. In the event of a big conflagration the horsed fire-engine is helpless if the horses have been taken away and sudden emergency renders it necessary to either advance nearer to or withdraw from the fire. The motor is seldom in danger at a fire, for it can be reversed or got out of harm's way, or if circumstances demand, it can be taken up closer to the scene of action.

It may be argued, notwithstanding the majority of fire departments contract for the hire of horses instead of purchasing them and keeping them on their own premises ready for a call, that we have not allowed for the reduced cost of maintaining a fire engine by hiring horses. The best commentary on such an objection is afforded by the following statistics drawn up by the Chief Officer of a foreign fire brigade:

Table A

Comparative Cost of Operating a Horsed Eire Engine and Escape and a Motor Fire Engine and Escape—Hired Horses

	Horsed	Motor
Initial cost of appliances, horsed, $3250.	.....	.....
Capitalized at 10 years.....	$ 400	.....
Initial cost of appliances, motor, $9000..	.....	.....
Capitalized at 10 years.....	.....	$1125
Contract for hire of horses.....	1350	.....
Repairs to harness, etc.....	50	.....
Extra wages to motor driver, etc.....	.....	250
Upkeep, oil, lubricating, tires, etc.....	.....	500
Annual expenditures	$1800	$1875

As this table was based on the amounts of the

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present contracts for the hire of horses, which were subject to short notice and could not be regarded as permanent, the fire chief preferred in his official report to his council to supplement the foregoing table with another estimate for the comparison of the expenditure, viz:

Table B.

Comparative Costs of Operating One Horsed Fire Engine and Fire Escape and One Motor Fire Engine and One Fire Escape—Horses Owned by Fire Department:

	Horsed	Motor
Initial cost of appliance, capitalized as before	$ 80	$ 225
Stabling for six horses, capitalized at 30 years	160	.....
Cost of horses capitalized at six years	425	.....
Cost of harness capitalized at ten years	45	.....
Keep of six horses $1,200, less use for Council work, $600	600	.....
Two coachmen and lad $1,000, less use of services in cleaning station and gear $500	500	.....
Wear and tear of harnesses, insurance of horses, etc.,	250	.....
Two motor drivers $1,000, less service in cleaning and acting as firemen..	750	250
Upkeep of motor, oil, tires, lubricating, etc.	.....	500
Annual expenditures,	$2380	$1875

It will be noticed that under table A, the cost of operating a horsed engine and a horsed escape is given at $35 less than our esimate for keeping a horsed fire-engine only, although in our estimate the horses are regarded as belonging to the fire department while in the latter case they are hired.

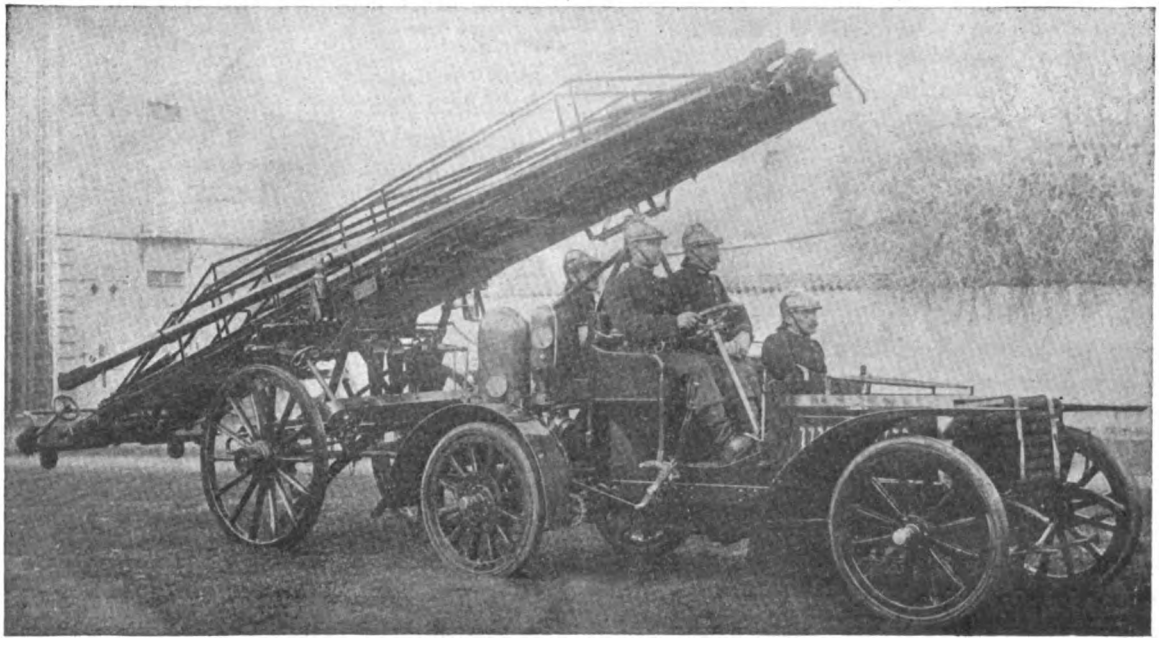
In table B the cost of keeping the horsed engine and horsed escape is $545 higher than our estimate for a horsed engine only, and this sum represents the approximate extra cost of keeping an escape with the engine.

The cost of maintaining a motor fire-engine we give at $1,606 per annum. The brigade fire chief already referred to reckons that $269 more will not only maintain a motor fire-engine and a motor fire escape but operate them as well. All our figures, therefore, are shown to be over rather than under results from actual practice.

Some fire departments are so convinced that the only proper method of getting fire vehicles to the scene of a conflagration is by using mechanical means of propulsion that they are discarding all their horsed machines. Vienna, for instance, has decided to re-equip its professional fire fighting department as well as its volunteer auxiliaries entirely with motor fire appliances.

Vienna Sets the Pace.

The municipality of Vienna has undertaken the most important work ever devised in the fire fighting world by this decision. An order has already been placed for 53 electric motor chemical fire engines and vehicles to replace the horsed chemical engines and vehicles of its brigades. At the moment no decision has been arrived at as to what shall be done with the horsed fire-engines and horsed mechanical escapes, but if they are not adapted to mechanical propulsion they will doubtless be entirely replaced by motor vehicles. Several have already been superseded by motor machines. There are two opinions as to the best method of propelling a steam pump, one favoring steam and the other electricity. The general opinion of the firemen is in favor of steam, although it was not until exhaustive experiments and inquiries had been made that the Viennese decided to purchase the 53 electrics. The experiments demonstrated the economy of the electric motor when applied to first-aid fire service vehicles. The mo-



Gasoline Fire Engine, With Escape, Used in Nancy, France.

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tors were ready for use before the echo of the fire alarm had ceased.

The Viennese firemen have always been noted for their smartness, but especially for their up-to-dateness. About eleven years ago all their manual fire engines were replaced by horsed chemical engines and more recently the hand raised fire escapes were replaced by 80 foot pneumatically raised ladders. Such wholesale replacements of course meant the sale or relegation to the municipal scrap heap of the old appliances, but the powers-that-be have never regretted the temporary loss of money thereby incurred. They were more concerned, even if there had been a promised total loss financially on the discarded machines, in preserving life and rendering their city safe against such catastrophes as visit imperfectly protected cities or areas, and of which the world has had fatal demonstration during the past three years or so.

Motor Vehicles Will Pay For Themselves in 11 Years

That this huge order for 53 motor fire vehicles will save Vienna life and money is apparent from a consideration of the fire brigade budget, by which the outlay is sanctioned. At present the particular service to be be taken over by the motors costs something more than $16,000 yearly over and above what the estimates provide for by the electrics, the total capital expenditure on them being $177,080. Eleven years' savings of $16,000 will amount to $176,000, more than sufficient with interest to repay the loan for purchasing the new machines.

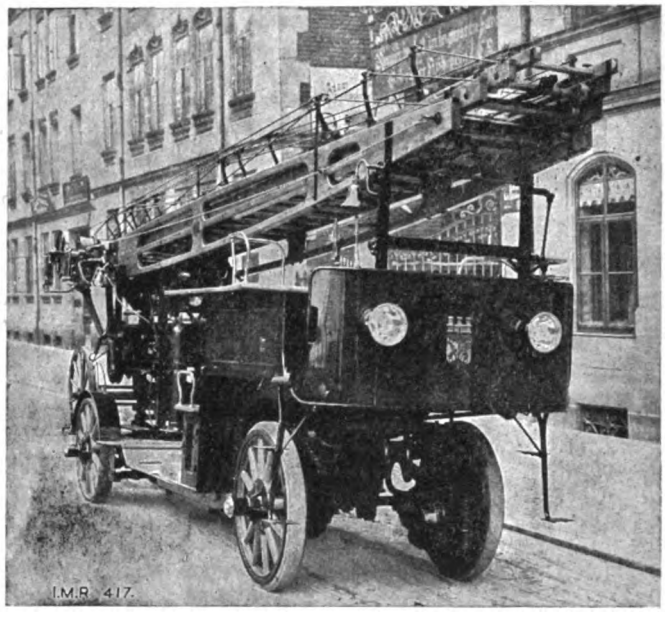
Berlin's Motor Fire Engine

Early this year the Berlin Schoneberg fire brigade got a steam motor fire engine having two 25 hp. engines in front of the vertical boiler, and these are used for driving the road wheels. The speeds attainable are between 25 and 35 kilometers per hour. Artillery type road wheels are fitted with solid rubber tires. The rear wheels are 60 inches in diameter and the front wheels 36 inches in diameter. Accomodation for six or seven firemen is provided, together with ample room for extinguishing paraphernalia, the total loaded weight of the vehicle being 4,500 kilograms. Two brakes are provided, one for general use being operated by hand lever, and the other for emergencies by steam. The steering is on the Ackerman principle, self-acting and absorbing all shocks from inequalities of the road.

This machine did remarkably well on a reliability trial at delivery. The distance traversed was 225 kilometers from Bantzen to Schoneberg, inclusive of some detours. Two days were occupied on the trip. An average speed of 24 kilometers per hour was maintained throughout the journey, but if the halts are eliminated the actual speed comes out much higher. The total consumption of water was 42 litres; petroleum 560 litres.

London Soon to be Without Horses

The London fire brigade hopes soon to be able to do almost entirely without horses. It is now making experiments with a view to converting its horsed steam



German Electric Escape.

fire engines to automobiles. The system is a German one and consists in taking away the two front wheels and axles of each horsed engine, and substituting a single wheel driven from the existing pumping engine. Several fire engines converted in this way are running successfully in Germany, and the London experiment is being watched with great interest accordingly.

Already, however, London possesses several motor fire vehicles. Three are in use at the brigade headquarters and other central stations. They have given such great satisfaction that another has been ordered in addition to three motor escapes. One of these latter has already been delivered to keep company with another motor escape of a different type in the service of an outlying district of the fire department. It was the work of this first motor escape belonging to the London fire brigade which decided the authorities upon getting three more, not exactly of the same pattern, but built to the design of the chief officer, Captain Hamilton, late of the British navy. All the London firemen are navy men. The new vehicles will combine with the escape a 60 gallon copper cylinder carried at the rear and fitted with a hose reel behind the driver's seat. This vessel contains only pure water, but two small cylinders of compressed air are connected to it so that on arrival at a fire high pressure can be turned into the cylinder to eject the water through the hose. The hose reel has a hollow spindle so that the water being taken at one end passes into the hose and is delivered at the jet, no matter whether the hose is wholly or only partially unbound. For use with hydrants a full sized hose is carried and stored with ordinary steam fire engine hose and utensils in a special box. The vehicle, therefore, acts as escape, first aid engine and hose tender to steamers.

London's Motor Escape

The London motor fire escape is of sliding carriage pattern having all the ladders trussed with steel tubes. Fully extended the escape is 55 feet long. Trun-

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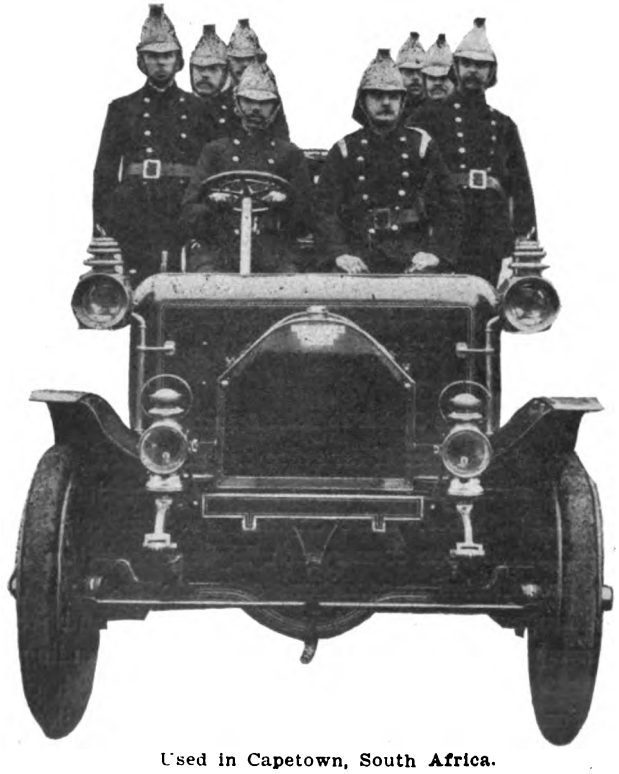
nions at the rear of the vehicle carry it when traveling, but it can be detached if necessary and run independently should narrow streets with sharp turnings have to be negotiated. When detached from the motor carriage the escape of course is wheeled by hand almost upright. The locomotive power is supplied by a gasoline motor having four water cooled cylinders. The hp. developed is between 40 and 50. Magneto and accumulator ignitions are provided, the engine power being transmitted by an internal cone clutch to a differential transverse countershaft, and then by a chain to each road wheel. The two brakes are fitted, one on the differential countershaft and the other on drums on the chain rings on the rear road wheels. Any ordinary hill was taken at 20 miles per hour on the test run of the three machines under order.

There are seventy-eight horsed fire-engine vehicles and ninety hose-carts still to supersede in the London fire brigade alone, irrespective of the outlying borough fire-brigades of greater London, before the metropolis can be quite said to be up to the times so far as fire services are concerned. The near future, however, will show that the London brigade is fully alive to its responsibilities.

American Motor Patrol Wagons

Several American fire brigades have been supplied with motor fire patrol wagons. The work of these vehicles consists in attending fires in their districts with the object of protecting merchandise and other goods from ruin by water, fire or smoke. The patrol wagons carry a large quantity of tarpaulins for this purpose as well as a dozen men on each vehicle to do the work. In Chicago there are about eight fire patrol companies scattered throughout the city. Heretofore horsed wagons have been used on this work; but there is little doubt that they will presently be entirely superseded by motors. One patrol wagon driven mechanically will do the work of three wagons drawn by horses besides saving about ten seconds or more of valuable time at starting and getting to the scene of the outbreak of fire anywhere from five to twenty minutes before the horses.



Used in Capetown, South Africa.

Gasoline Tri-Cars in Hamburg

Hamburg was probably the first city to provide its firemen with gasoline tricars of three hp. for first aid purposes. On receiving an alarm two firemen mount the machine and start off at once to the call where they direct operations with such appliances as may be at hand until an engine arrives. In this way many conflagrations have been suppressed in their beginnings and valuable property saved. The presence of the firemen calms the excited persons whose premises may be alight, and much ignorant bursting of doors and smashing of windows to let the smoke escape, but in reality creating a draught to fan the flames, is prevented. Besides occupying little space the tricar has a speed which permits it to worm through traffic and arrive at a fire much quicker than any other vehicle.

Electric Fire Apparatus in Paris

Paris possesses an electric motor hook and ladder fire wagon carrying six men and first aid appliances, ladders, ropes, nets, a reel of hose, etc. The electrical ladder is hoisted perpendicularly by means of a motor windlass. The electrical ladder forms the chief feature of the motor carriage which, with the two ladders, weighs 9,150 pounds. In addition to this machine Paris has also several motor first aid engines consisting of water cylinders and hose reels which operate in much the same way as those on the London fire-motors already described.

Hanover's Electric Hose Wagon

Hanover, after a very short experience with a motor fire engine, decided on the purchase of as many as might be necessary to bring its chief station up to date. The Lolmer-Porsche electric hose wagon in particular is very popular in Germany. This machine is propelled by two electric motors driving the steering wheels, the current coming from a battery of 84 cells carried beneath the firemen's seats at the rear of the driver. This battery enclosure permits of four men riding on each longitudinal seat. Three more men can ride on the rear step and one, in addition to the driver, on the front seat. Any reasonable amount of hose is carried. The carrying of an ordinary fire escape or ladders is made possible by an iron frame-work behind the front seat and another at the back, on which the ladders rest, being sufficiently high to clear the men's heads.

Glasgow's Remarkable Vehicle

Pushful Glasgow has recently invested in a motor chemical fire engine and a motor turntable fire escape and water tower. The former has been designed to meet the requirements of the fire chief for a vehicle which can reach the scene of an outbreak of fire with the least

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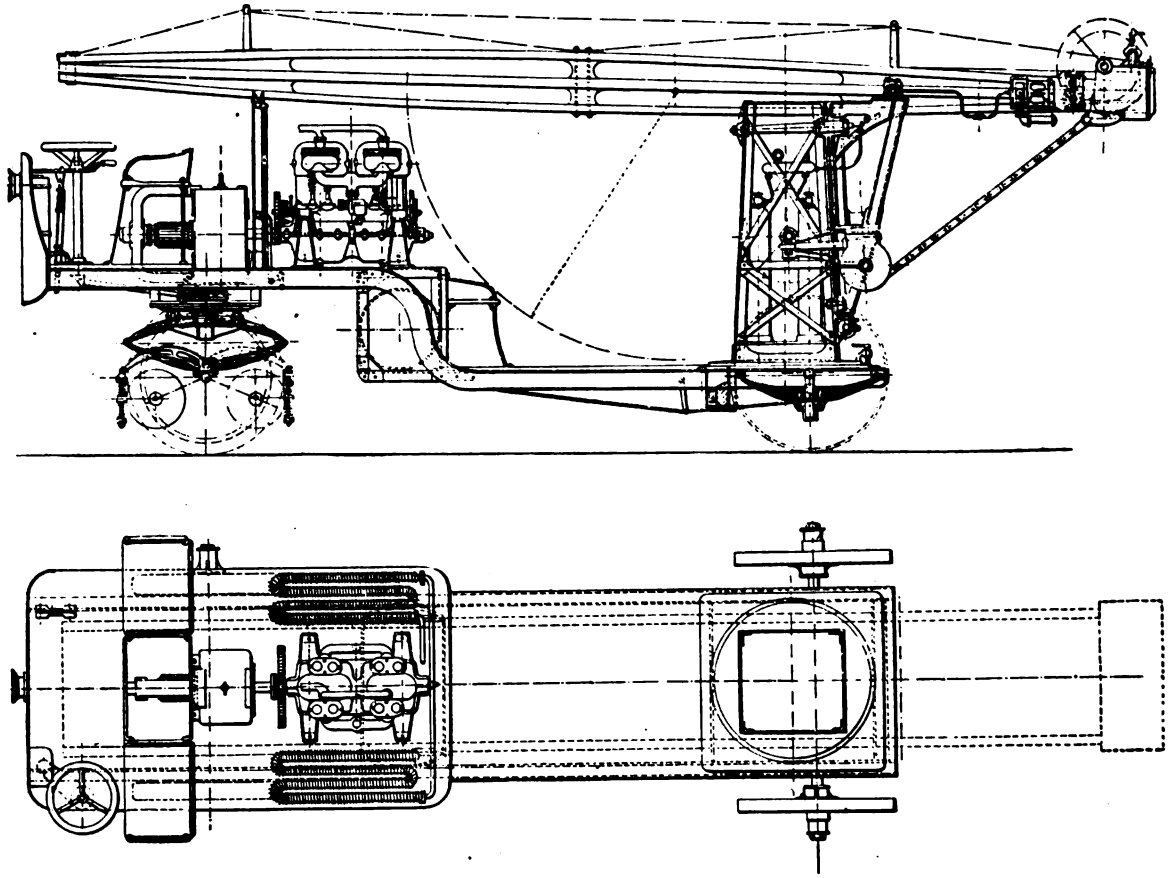
possible delay, and when there cope with the fire in its early stages and hold it in hand, if not extinguishing it, before the powerful but slower traveling pump arrives. In Glasgow a horsed fire-engine going to a fire only one mile distant from the fire station required five minutes to make a mile trip and the chemical motor at 20 miles an hour needs but three minutes—only the saving of a few minutes, but in a city like Glasgow, with its dense population and narrow streets and huge buildings, this 120 seconds may decide the fate of scores of human lives and much property. The motor chemical fire engine is equipped with a 50 gallon chemical cylinder sufficiently large to extinguish 70 or 80 per cent. of fires provided it is on the spot in time. The locomotive operating cast iron blocks expanding inside the chain rings on the road wheels, is manipulated by a foot pedal, and is compensated so that the braking effect is equalized on both chain rings and no skidding may be set up by an unequal retardation of the road wheels when the brakes are applied.

It is not generally recognized that unequal braking of the road wheels of a vehicle sets up a differential action and gives the vehicle a tendency to skid on the side opposite to that on which the road wheel is permitted to run fastest. Many accidents and collisions have occurred by bad non-compensating brakes on vehicles which have been pulled up suddenly in traffic and, overcoming the steerage,



Gasoline-Electric Motor Turntable Fire Escape Used in Glasgow.

power is provided by a horizontal 4-cylinder 24 hp. gasoline motor. The frame is built of channel steel with stiff gusset plates and transverse members to reinforce it. The wheel base is 9 feet 6 inches. The motor is below the frame. Solid rubber tires are used on the rear and pneumatic tires on the front road wheels. These latter are artillery pattern, the rear being 40 inches and the front 36 inches in diameter.

Special Features of Construction

The axles of the Glasgow chemical motor fire engine are fitted with plain phosphor bronze bearings, each axle being of special steel. The wooden wheels are reinforced with wire spokes in order to strengthen them and obviate any risk of collapse by side strain caused by side slips, collision with curbing, or taking corners at high speed. Two very efficient brake systems are provided. One, have swerved with great force into some obstacle or vehicle.

The side brake lever on the Glasgow motor fire engine brings into action brake bands on drums on the chain rings.

Brakes Should be Pedal Operated

It would be better if on a fire engine all brakes were pedal operated in order to leave the hands of the driver entirely free to steer. Fire engines travel in congested traffic and in the open country at a higher speed than any other vehicle in similar conditions of traffic, and it is extremely dangerous for the driver to take his hand from the steering wheel to apply the brake when rounding a corner at 20 miles an hour or pulling up among a conglomeration of other vehicles at 30 or even 15 miles an hour. A steering wheel is easily controlled, but the in-

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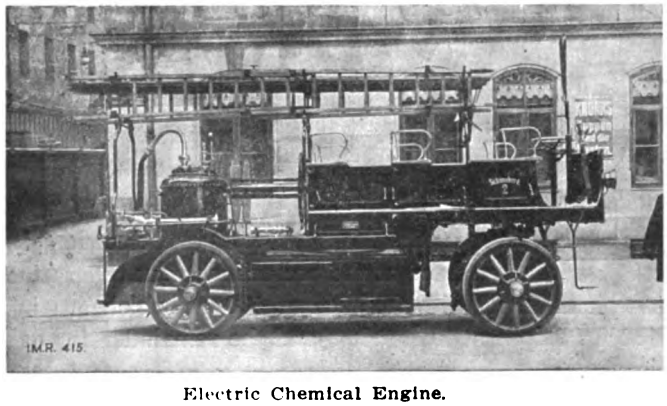
stinct of human nature is to take the eyes for a moment off the road and glance at the brake lever. A moment's inattention may cause the machine to wreck itself.

The gasoline tank of the Glasgow chemical fire motor is of copper and has a capacity of 10 gallons. The total load capacity of the vehicle is 2,500 pounds, the weight of the vehicle being 2,000 pounds.

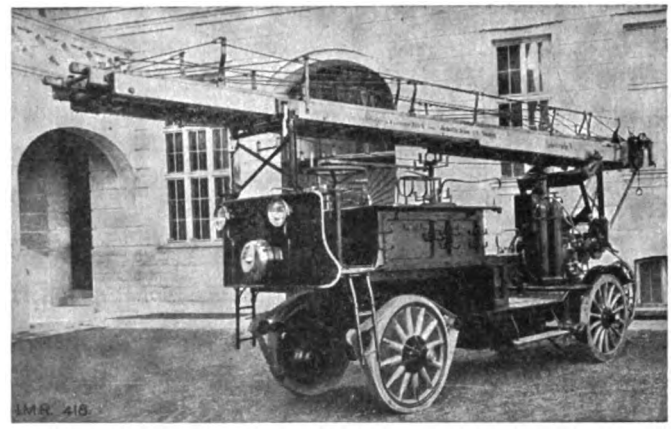
Gasoline-Electric Turntable Fire Escapes

The other motor fire vehicle owned by the Glasgow corporation is a 30 hp. gasoline-electric turntable fire escape and water tower. There are quite a number of machines of this type in use on the continent. The motor is the ordinary vertical gasoline type fitted with magneto and accumulator ignition. As will be seen from the accompanying drawing, the motor is mounted on vertical brackets bolted to a secondary frame just inside the main frame. The crankshaft of the motor is coupled to a dynamo mounted also on the secondary frame in a position just over the front axle. Front wheel driving is used. By the front wheel system of driving practically all tendency to skid is avoided and the maximum efficiency of the power plant is obtained for really tractive purposes, all the power developed being used in pulling the vehicle instead of propelling it. It requires quite 10 per cent more power to propel a vehicle than to pull.

The dynamo of the Glasgow motor escape drives two motors fixed on opposite sides of and beneath the front of the frame. Each motor is geared to and drives a front road wheel. The pinions of the motor are meshed with internal gear rings on the road wheels slightly below the centers of the wheels. In this way the forward or near side motor pulls its road wheel downward and forward, and the rear or off-side motor pulls its road wheel upward and forward—the two motors in combination, giving a continuous pull to the vehicle without a dead point anywhere. By a reference to the elevational drawing it will be seen that the near side or forward motor is situated in front of the front axle and the off-side or rear motor just behind the front axle. A close examination will also show that the motors are suspended by semi-elliptic horizontal brackets from the front axle. The brackets are suitably stayed to keep them perfectly rigid with the axle, but the motors, it will be noticed, rest by legs between coil springs on the bracket suspension rods. In this way the motors have a vertical and downward movement sufficient to take off all road shocks. The



Electric Chemical Engine.



Electric Fire Escape.

driver sits in front of the dynamo. The gasoline tank is positioned beneath the motor at the drop in the frame.

The frame has a deep drop in it behind the gasoline motor in order to permit the escape, when fully extended and upright, to sweep over the lower part of the frame without obstruction when being turned. The turntable is perfectly free to move circularly in any direction. No gear is used to turn the escape tower, as it is provided with ball bearings on which to run. A special releasing gear is provided for unlocking the ladders from a traveling position, and by the same action taking the weight of the whole machine off the rear springs. Twenty seconds only are required in which to fully extend the escape. This is a faster operation than is possible with other systems. The machine is an ideal escape, bridge, and water tower combined. It can reach the scene of a fire while ordinary escapes are getting under way. Constant supervision in the engine houses or at fires is also unnecessary, every fireman being occupied in fighting the conflagration. The vehicle has a full half-lock and is consequently extremely handy in traffic. A patent controller is provided to regulate the speed forward in four changes up to 20 miles an hour, with reverse on two speeds, and electric brake.

South African Motor Fire Engines

Capetown possesses two steam motor fire engines as well as two gasoline vehicles. The steamers are similar to four owned by Liverpool, three owned by London and several owned respectively by Edinburg, Cardiff, Portsmouth, Plymouth, Yarmouth, Brighton, and other fire brigades in England, Egypt, Burmah, India and Australia. The frames of these vehicles are either of channel or I-section steel. Wheels are of artillery type. Solid rubber tires are usually fitted, single in front and twin on the rear. The carriage is mounted on elliptic laminated steel springs with wrought iron axles. Of the four motor fire vehicles possessed by Capetown one is an oil-fired steamer of 300 gallons capacity. It cost $4,750. Another is an oil-fired steamer of 800 gallons capacity, with steel tires, costing $8,750. The larger sized pump will throw a jet nearly 200 feet high.

The third Capetown fire motor is constructed for tender work. It is, however, of 12-16 hp. only, as the chemical cylinders are omitted and there is consequently less weight to carry. The reel is capable of holding 2,000

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feet of hose which can be used on hydrants or the steam motors when they arrive. The extincteurs hold a small fire in check until the hydrants or steamers get to work. The long length of hose makes the vehicle peculiarly suitable for country fire brigade work where water often has to be pumped a considerable distance. The hose sections, of course, have to be unrolled before they can be used, as they are full canvas size—only the chemical hose reels are capable of working with the hose unwound.

Capetown's Latest High Speed Machine

The latest acquisition of Capetown is a complete chemical fire motor of 35 hp. and combines with the chemical cylinders the duties of hose tender with ladders and other life saving apparatus. The gasoline motor is of the four cylinder vertical type with double ignition, electric and high tension magneto. No governor is used, as the gas is throttled when the clutch is released. It is fitted with artillery type road wheels and solid rubber tires. On the road the speed of the vehicle is from 30 to 40 miles per hour. The hose tender carries 1,000 feet of 2 1-2 inch hose. The usual complement of men with drivers is seven, but there is room and power enough for a dozen men.

Cost of Motor Fire Pumping Engines

The price of motor fire pumping engines varies with their capacity and auxiliary appliances. The 300 gallon vehicles, fitted with steel tires and coal burning furnace, cost $4,220, with oil burner, $4,750, and with solid rubber tires, $5,000. Engines with a capacity of four, five or six

Capetown Gasoline Hose Wagon.

hundred gallons per minute pumping capacity cost $250 more under each of the foregoing categories for every hundred gallon increase. Engines with one thousand gallons capacity, coal burning furnace and steel tires, cost $10,250, with oil furnace and steel tires, $10,750, with oil furnace and solid rubber tires, $11,250, and with oil furnace and wrought iron instead of wood wheels and iron or steel tires, $11,375.

Electric First Aid Fire Vehicles

British and continental fire departments are being supplied with first aid electrically driven fire vehicles. The storage batteries of these vehicles are placed in front. The number of cells used is 80, giving a running capacity of 30 miles. It is seldom, however, that this distance has to be covered in a single fire call, so that there is no risk of the vehicle not being able to reach a fire. The batteries are connected to two electric motors, one on each side of the front wheels in much the same way as are the motors on the Glasgow motor turntable fire escape. There is, therefore, a direct drive on each front wheel, as the motors work independently of each other and do not require that any compensating or differential gear be fitted to the vehicle. Each motor accommodates itself to the circle of travel and tractive resistance. In the case of a collision or injury to either of the motors, the other at reduced speed will carry the machine to its destination or home.

The steering and control of the electrical vehicle is very simple. Immediately under the steering wheel, fitted to a vertical steering pillar, is the controller handle which moves on a semi-circular gauge and operates five speeds, two brakes and two reverse movements. A mechanical brake is also provided and is worked by a second man on the front seat. The use of this brake automatically cuts off the power current. Two recharging plugs are carried. The estimated cost per mile run is 5 cents.

An electric fire motor is in use in Vienna which has run 3,000 miles during the past three years and the fire chief considers the batteries will run another 3,000 miles before they will require renewal.

(*To be Continued*)

MOTOR PLOWS

ALTHOUGH the motor plough examined by leading Egyptian agriculturists on Boghos Pasha Nubar's land gave a surprising performance, particularly on dry soil, in which by an ingenious combination of the blades it mixed manure while simultaneously ploughing up the earth, it would be interesting to know the real origin of the machine. Boghos Pasha Nubar is said not only to have invented, but also to have constructed it.

Though his excellency may have mechanical talent, there can be little doubt that this apparently successful application of motor power to a complicated system of rectangular shares and blades, cutting and winding in rotary motion through the ground, its first passage over which is said to equal the second application of the ordinary steam plough, must have originated wholly in construction, and partly in design, in a European engineering shop.

Boghos Pasha Nubar visited Italy some time ago. From the notices appearing in the German press, however, it looks as though Germany is the true birthplace of the machine.

Time will prove whether the operation of ploughing a 12-foot belt over 6,739 meters of ground in one hour, 20 centimeters in depth, and with a consumption of 100 kilos of fuel for every 0.4 hectare ploughed, will be repeated on sodden land in the wet season. On this depends whether the machine is to remain the hobby of a millionaire, or is to supplant the motor ploughs and diggers now being so extensively used by Egyptian landowners.

A French concern making a specialty of electric cabs states that it has in hand at the present moment orders for 817 vehicles fitted with taximeters, 530 of which are intended for shipment to London, and the remainder for use in France.

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Care and Maintenance

Tips to New Drivers and Caretakers About Things Likely to Escape Their Attention

CHAINS seldom receive the care they deserve, and as a consequence work less freely and are less efficient in transmitting power than would be the case if they were properly lubricated and looked after. A chain should be always free and supple, and to preserve it in such condition it is necessary to lubricate it freely when in work and position, to keep it very clean, to remove all mud, and prevent rust by rubbing with a rag smeared with vaseline, or soaked in gasoline. A good method of lubricating a chain is to dismount it, roll it up upon itself, and place in an open flat pan deep enough to allow of it being covered with melted vaseline, the pan being placed over a fire for the purpose of liquefying the lubricant. It is hardly necessary to suggest that the chain should be thoroughly cleaned from all dirt and dry grease in a bath of gasoline before it is simmered in the liquid vaseline. Having allowed the chain to stew for some time, the pan should be removed from the fire and its contents allowed to cool. When taken from the pan, the superfluous grease only should be wiped off. This method will introduce lubricant between every frictional part of the chain, and is the only method by which unprotected chains can be made to run satisfactorily.

Driving Round Curves

Corners should be taken slowly. If taken fast the centrifugal force tends to make the wagon proceed in a right line tangential to the curve and further causes the rear wheels to thrust outward against the road surface, and sometimes to slide perpendicularly in the direction in which the wagon is moving. At such times all the weight of the vehicle is sustained by the two outside wheels, and a considerable thrust is therefore sustained by them. This thrust, if the road be dry, is counteracted thereby, and the stress of such counteraction is borne entirely by the tires. Further, when rounding bends of any severity it is always advisable to declutch, and round the curve running free, for then not only is the additional driving strain taken off the tires, but the differential gear is relieved of a stress which it would otherwise have to sustain at an undesirable moment.

Parts that Require Attention

Though certain parts are out of sight they should not be out of mind. Nuts and pins do not loosen and drop off all of a sudden; their defection is the result of continued vibration, as a rule, and they start and turn or loosen very slowly, probably taking as much as a fortnight's constant running in some cases to get to a point where they finally drop off and cause trouble. Occasional inspection with a wrench will do much to avert involuntary stoppage. This is particularly true of the cardan shaft. It is seldom looked at except when the body happens to be removed for other repairs, but the occasions on which it has been at fault are sufficiently numerous to make it a wise plan to feel its joints from time to time and see if they have developed too much play. Also see whether the shaft is still in line or if it has sprung just enough so that with a few months' wear it will ruin the bevel pinions.

How to get the Best Work out of a Motor

Here are three good fundamental rules for getting the best work with the least consumption out of your engine:

1. Drive with ignition advanced to the utmost short of getting engine knock.

2. Admit as much air to the carburetter as possible short of getting misfires. This, of course, only obtains with carburetters in which the air supply is controllable.

3. Never let the engine run hot or in want of the proper supply of lubricating oil.

Rain Water for Cooling

The kind of water used in the cooling system is a matter of greater importance than is apparent at first sight. There is always more or less evaporation going on, and if the engine happens to run hot the water boils more or less actively. If it be of a mineral nature there will be a considerable deposit in the radiator and the other metal parts of the system at the end of a season's running. If it be available it is advisable to use rain water for this purpose.

Use of the Brake

The highest efficiency of the brake is reached at the point which will stop short of causing the wheels to slide without turning. Tires suffer severely from the friction with the road. Moreover, as soon as the wheel begins to slip the braking action is considerably lessened, and there is a strong tendency for the rear wheels to slew around sideways. The pressure required on the brake varies with the speed, for the reason that the higher the speed the smaller the coefficient of friction in the brake.

Abuse of the Engine

Racing the engine is one of the unnecessary abuses to which many wagons are subjected by careless or ignorant drivers. The practice of withdrawing the clutch without throttling or retarding the spark; of letting the machine stand with motor operating; of using the low gear with the motor turning over at top speed when a higher gear could be used with a little careful handling —these things take more out of a wagon than many miles of ordinary road work, not to mention the waste of fuel they imply.

When Gears Grind

If the grinding of gears comes on by degrees in a wagon ordinarily well behaved, it is an indication that the gear shaft bearings have been cut so that the shafts are badly out of line. Trouble of this sort should be investigated at once, as nothing will wear the gears so fast as

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to mesh improperly. Sometimes, however, the trouble is due simply to the change of ratio between adjacent gears being too great, so that the difference in pitch-line velocity is greater than can be overcome by forcing the teeth of the gears together. Trouble of this sort is more apt to show itself in changing from first to second speed. In changing from a lower to a higher gear, it is evident that the effect of the change is to reduce the speed of the engine and increase that of the wagon, and the same change must be impressed on the gears connected respectively to the clutch and to the rear wheels. Instead of simply unclutching and shifting the gears from the first to the second speed position, retard the speed of the engine when the gears are disengaged, and if before the wagon has time to slow down we impress the same change of speed on the gears connected to the clutch, it is evident that the ease with which the gears can then be engaged in the higher speed will be greatly enhanced. To do this proceed as follows, after starting in first speed: Open throttle and accelerate the wagon till the motor is running at its normal speed; close the throttle and immediately unclutch and shift the gears to the neutral position between first and second speeds, allowing the motor to slow down while the wagon coasts; then momentarily engage the clutch, thus retarding the driving gears to suit the speed of the motor; then unclutch and shift the gears to the second speed, when it will be found that they go into mesh with hardly a sound.

Cleaning Spark Plugs

Spark plugs need occasional cleaning by unscrewing the two parts and cleaning off points with gasoline or emery cloth. When mica plugs get so full of oil as to be useless they may be made serviceable again by baking till smoking ceases. The points should only be separated about the thickness of a dime.

Cranking the Motor

When cranking a motor the starting handle should be pulled up, not pushed down. The handle should engage the racket on the crank shaft when it is in a position corresponding to 7:30 on a clock dial and then should be pulled up sharply. Do not jerk, but on the other hand, the pull should not be sluggish. If the motor is cold it may be necessary to crank it in this manner three or four times before it starts. If warm, it should start on a quarter turn.

Adjusting the Vibrator

The correct adjustment of the vibrator on the coil is an important matter, not only from the fact that a better spark is produced when the adjustment is right, but also because the current consumption depends to a considerable extent upon the swing of the little spring. Set the "buzzer" so that it sings the highest note it can sustain clearly and without harshness. This can be done by first screwing down the adjusting screw until the buzz is stopped. Then gradually turn back until a high, clear buzz, without rattle or hoarseness, is obtained. With dry batteries it is sometimes necessary to slack back the screw a little more as the cells run down. It is, of course, possible to set the vibrator so that it will work fairly well whether the battery is new or in the last stages of its usefulness, and a majority of coils are so adjusted, but to make a new adjustment, or to get the best work out of the coils, the above method may be followed.

Adjustments to Let Alone

Do not meddle with the trembler coil or the carburetor adjustments until it is positively known that they need it. Unless these adjustments have been monkeyed with they are correct for the next run just as they were when the wagon was put away after its last trip. There is no guess work about a gasoline motor, opinion to the contrary notwithstanding, and if everything is as it should be the motor will start on the first turn. Atmospheric temperature affects the vaporizing qualities of gasoline, but that is all.

Don't Neglect the Machine

Don't try to make your truck do the work of a half a dozen teams without giving it any attention.

A Handy Remedy

A little powdered chalk works wonders on a clutch or brake that will not hold as it should.

MOTOR PLOWING IN WEST INDIES

THE following extract from the latest issue of the "West India Committee Circular," referring to the benefits derived from the adoption of motor ploughing in two such dissimilar islands as Trinidad and Antigua, may prove of interest to our manufacturers:

"On the Caroni estate in Trinidad a considerable area of canes grown on land ploughed by motors has been cut this year, and the average yield of plant canes per acre has been 34 tons, as compared with 23 tons from land cultivated under the old system. The total cost of cultivation of the motor-ploughed lands, after allowing for wages and expenses, and for ten per cent depreciation on the cost of the ploughs, proved to be less than under the old methods, so that the result is an increase of 50 per cent in the yield of canes per acre, without any increase in expenditure. In Antigua motor ploughs are now at work on two new central factory estates. On one they are ploughing a piece of land which would otherwise be practically untillable in its present condition with either ox ploughs or manual labor, and they are not only ploughing the land, but pulverizing it very satisfactorily. On the other they are also doing excellent work on land which hitherto defied the old-fashioned methods of tillage."

MOTOR BUSES IN SPOKANE

MOTOR buses will soon be running between Spokane, Wash., and Moran Prairie, eight miles distant. The operating company has secured right of way through one of the most picturesque portions of the Spokane valley. Ten cars will be put into service. It is the intention to compete with the electric cars.

The postal authorities of Prague, Austria, have decided to collect letters by motor tricycle. A saving of 1 1-2 hours time is effected in clearing 37 postal boxes.

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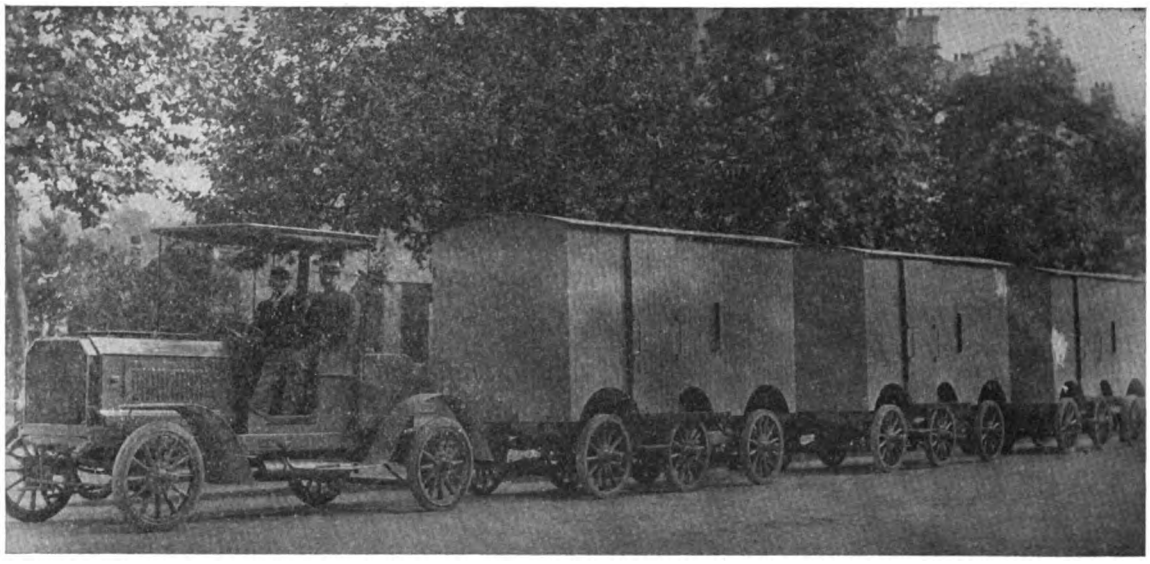

Renard Road Train

Advantages and Characteristics of the Locomotor and Its Six-Wheeled Trucks

WHEREVER the work of the Renard road train has been intelligently applied its advantages have seemed very conspicuous. Its usefulness in military transport is well established. In the service of market gardeners, farmers, and fruit growers adjacent to large cities it has given a good account of itself.

The distinguishing characteristics of this train, aside from the economy which its use affords, are as follows:

1. Each vehicle in the train follows accurately in the track of the locomotor, without tendency to side-slip or cut corners.

2. The whole train can be backed with like accuracy.

3. The brakes of the whole train are under control of the driver.

4. The adhesion of the driving wheels depends upon the weight of the whole train and not upon the weight of the locomotor.

5. The train causes no particular damage to road surfaces.

6. Single-handed control from locomotor.

7. No fixed limit to the length or weight of the train.

8. No difficulty in backing out of awkward positions.

9. No accident if a wheel or axle should break.

10. No accident if a coupling should break, the flexible transmission being in itself sufficient.

11. Ability to travel over roads that are unsuitable for exceptionally heavy traffic, such as traction engines, owing to the weakness of bridges or the inadequacy of the road foundations.

12. Low first cost of establishing service.

The train consists of a locomotor—a powerful motor vehicle of standard type—and several trailing six-wheeled trucks. The center pair of wheels on each truck are driven by the engine of the locomotor through a differential gear and flexible couplings. The number of trucks which may be employed depends solely upon the power of the engine. Observe that each vehicle is propelled and not drawn.

Steering gear connects the front of each vehicle with the rear of the preceding one. The action of this mechanism is so perfect as to give the impression that the train is operating on rails. All vehicles in the train being self-propelling, it is not necessary that the locomotor be placed in front. And as the brakes on all trailing vehicles are under single control, it is apparent that the train may with safety be operated at considerable speed on good roads.

The advantages which six-wheeled vehicles possess have been pointed out in a previous issue of this paper, so that it is not necessary to refer to this particular feature of the Renard train trucks for any other purpose than to reaffirm the statement that low cost of upkeep is a characteristic of this method of suspension. This economy is due to the balancing of the load, the stability of the chassis, and the division of the steering function. Each of the six wheels in each truck bears its own share of weight regardless of the quality of the road surface.

The transmission of power is effected through the medium of a shaft, consisting of portions 1, 2, 3, 4, and 5, connected to one another by universal joints. The portion 2 passes through the differential casing, and drives the intermediate shaft 12 through the medium of a secondary gearshaft and bevel wheels, as shown. From the intermediate shaft the drive is taken by side chains to the driving wheels 14, through the compensating springs contained in the casings 16.

Study of the movement of the train shows that while in the act of "coiling up" on a curve of decreasing

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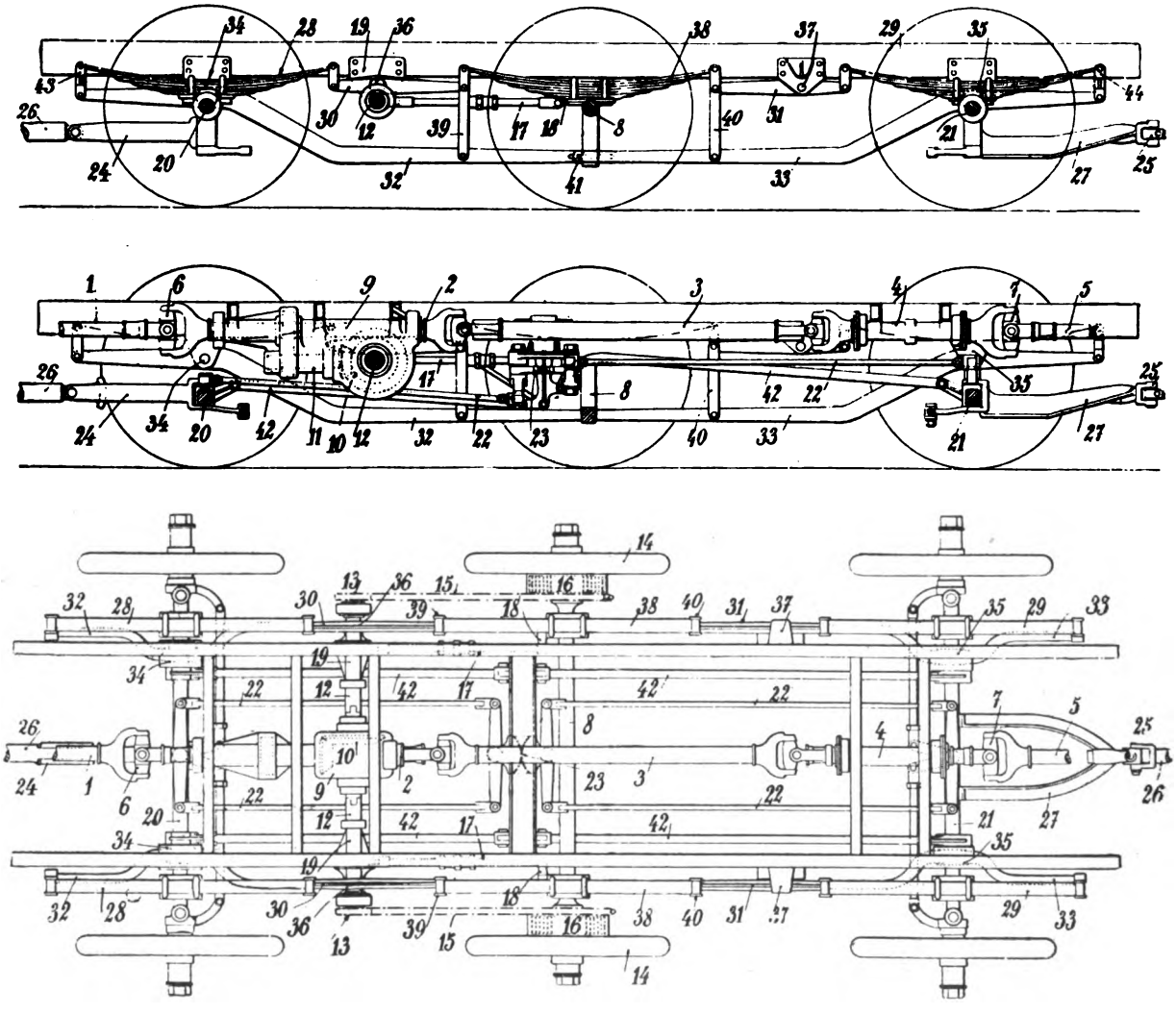
radius, the distance reckoned along the curve between two consecutive driving axles diminishes. On the other hand, when the train is straightening out this distance increases. It is thus apparent that the trailing vehicle would be obliged to slip forward along the road in the first case, and backward in the second. This is prevented by the action of the compensating springs, which are arranged as shown.

The casing "a" is in one with the sleeve "b," and so forms a part of the hub of the wheel, rotating solid with the latter. This portion carries two projections "d d," against which bears one end of the spiral spring "c". The lid of the case in which the spring is contained is formed by the chain wheel "g," from the inner side of pieces projecting from the supports of the intermediate shaft 12.

In order that all six wheels may bear upon the road, in spite of undulations or obstacles of any sort, without causing a material redistribution of the weight on the three axles, the springs 28, 29, and 38 are not fixed direct to the chassis, but their extremities carry links which are suspended from the levers 30, 31, 32, 33. These levers support the chassis at the points 34, 35, 36, and 37. The ends of the center springs are also connected by the links 39 and 40 to the levers 32 and 33.

The connection 41 between the levers 32 and 33 allows of the transmission of any movement of one of these levers to the other. This arrangement results in



which projects the square dog "f". The result of this is that, according as the driving wheels are required by the curves of the road to gain or lose on those of the preceding vehicle, so the dog "f" moves in one direction or the other, compressing one end of the spring "c," and allowing each vehicle to approach or recede without any slip of the driving wheels on the road surface. These compensating springs also serve a subsidiary purpose in softening the drive from the engine.

The driving wheels transmit motion to the chassis by means of the torque rods 17, which are secured at one end to the blocks 18 on the axle 8, and at the other to an upward motion of the central axle when the two others fall, and vice versa. In order that the weight of the load may be equally distributed over the three axles, the points 36 and 37, about which the levers 30 and 31 turn, are situated at one-third the length of the levers from the outer ends. Similarly, the points 34 and 35, the fulcra of the levers 32 and 33, are at one-third along the distance which separates the points of attachment of the links 43 and 44 from the links 39 and 40. Thus if we divide the load into halves two-thirds of each half is taken by an end axle and one-third by the central axle, giving an even distribution of the entire load.

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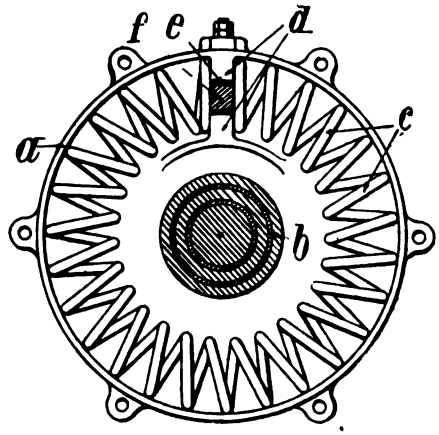
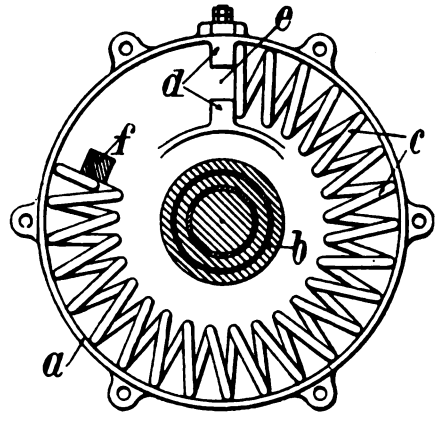
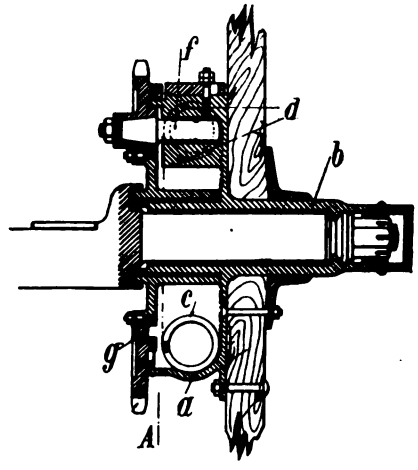
We shall make no attempt to detail the steering gear of the train. The various considerations involved, necessitating a considerable amount of calculation and a large number of diagrams, would occupy more space than we can afford to give the subject. The steering gear of the front portion of each vehicle is similar to that for a four-wheeled chassis. In practice no difficulty is found on curves of varying radius, while the details







are worked out in such a way as to allow the train to be steered backwards over any distance and course by a man in the back vehicle.

Another mechanical device of considerable interest is the "variator". This is practically a gear which is set before the train is started, and by its agency the speed of the train, corresponding to the normal speed of the engine, is varied. For example, for heavy loads the maximum might be ten miles an hour; for light loads on suitable roads the variator might be set to give twenty miles an hour as a maximum; while the locomotor running alone might be allowed to speed up to forty miles an hour, becoming under these conditions a fast and powerful car for touring or express work.

FRONT WHEEL BRAKES

FRONT wheel braking has many supporters who will be interested in learning of the latest development in that line, namely, a device which while effectively applying brake power yet does not interfere with the steering. The brakes are outside bands, taking effect upon drums fitted to the inner flanges of the steering wheels.

Another feature of the device is the steering control, which makes the front wheels absolutely rigid if desired at the moment of braking, in relation to the body of the vehicle, at whatever angle they may be turned. This control is obtained by means of a segmentally sectioned metal rim, placed immediately underneath the steering wheel rim, and formed with finger grip. When the front wheel brakes are applied and the vehicle shows any symptoms of side-slipping, due to the application suddenly or otherwise of the brakes, the under segmental metal rim is gripped up to the steering wheel proper, and so held rigid by reason of the fact that the metal rim is secured firmly to the steering standard, which cannot turn.

The inventor suggests that after a little wear the worm and sector steering gear generally used is not irreversible—that is, it does not prevent the front wheels from being affected by road obstacles. This is in a measure true. Neither does it obviate the swinging of the back of the car on the steering centers independently of the front wheels. With the new steering gear both these failings are shown to be prevented.

The dual apparatus has been tested on a heavy motor bus, and both as a preventive of side-slip and as a handy and efficient brake is highly spoken of.

MORE U. P. RAIL MOTOR CARS

IT is believed that the Union Pacific railway company will soon establish individual rail motor car service between Beatrice and Lincoln, Neb. People in Beatrice believe that the same service should be established between Marysville and Lincoln, as it would bring Beatrice into closer touch with the territory in the south part of the county and the towns in northern Kansas. As the trains run at present, it is impossible to make a trip from Barneston, Holmesville, Blue Springs or any towns south of Beatrice, to that city and return the same day.

At a meeting of the directors of the Columbus Sight-Seeing Company, of Columbus, Ohio, it was decided to extend the present service, which consists of sight-seeing by automobile, and operate a motor package delivery system. Several small gasoline vehicles have been ordered for this purpose.

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Thousands of Buses

Development of a Movement Which Has Attained Surprisingly Large Proportions

AT every fresh census of the motor buses plying the streets of London one is strengthened in the opinion that before long the entire field of public transportation in the principal cities throughout the world will be given over to motor driven vehicles. Horse drawn vehicles for public hire will practically have disappeared within five years from date in such cities as London, New York, Paris and Berlin, if motor cabs, broughams and other types of modern passenger conveyances become specialties in manufacture like motor buses.

At the end of the first week in September there were 664 motor buses in commission on the streets of London. The chassis for 100 more were at that time being fitted with bodies, but as body making is not keeping step with chassis assembly the rate of production of finished vehicles is not more than 20 a week. The distribution of machines among the various operating companies is now as follows:

London Motor Omnibus Co.	157
London Road Car Co.	105
London General Omnibus Co.	112
London and District Motor Bus Co.	45
Thomas Tilling	31
Great Eastern London Motor Omnibus Co.	42
Star Omnibus Co.	23
Associated Omnibus Co.	24
London Power Omnibus Co.	34
Birch Bros.	15
New London Suburban Omnibus Co.	10
Victoria Omnibus Co.	8
Motor Bus Co.	11
Other owners	47
Total in use	664

But impressive as these figures are they by no means represent the full extent of motor bus traffic in England. In fact, counting the machines operated by steam railway companies as feeders to main lines, the machines in use in small and large cities, and the machines which are in touring service everywhere throughout the country, the number employed in London is found to be not more than one-third of the total of such vehicles in use.

It is expected that by the end of the year almost 1,000 motor buses will be in commission in London, representing an outlay of about $3,500,000. Nor will the buying stop with this investment; for the London market can easily absorb 2,000 of these machines to meet its immediate necessities, take 500 more for spares, and another thousand to develop routes hitherto neglected or to replace worn out or obsolete early types. Several continental cities, where omnibus transportation is a fixed feature of the civilization, will also be heavy buyers at once and in the future. So that, upon the whole, this branch of the industry may be looked upon as firmly rooted and certain to flourish for a long time to come.

Spasmodic efforts have been made in this country to establish the utility of the motor bus. Not under the same conditions, however, which mark the movement abroad. With us the motor bus is chiefly employed in interurban service. Its value is clearly enough recognized in this field, but the poor care which the machines receive, the inexperience of the operating companies, the inferior highways and the high rate of speed at which the vehicles are driven do not greatly encourage the hope that there will be a very active development in the use of motor buses in the rural districts for some time to come. On the other hand there is hardly a city in the country which could not employ them to advantage despite the present excellence of street railway services.

Every little while we witness the extension of city surface railway lines. Some hitherto unserved district is to be given much needed transportation. As the same opportunity is presented in London it is siezed not by the street railway operators, but by the motor bus companies. The route for a cross town street railway line must be long before it can be made to pay, and it must be direct if its cost of construction is not to be excessive. The flexibility of the motor bus route is its chief advantage. It can be varied until there are practically no unprofitable spots in it.

Thick as New York, Chicago, Philadelphia, Boston and other large cities are sown with surface line rails, it is nevertheless absolutely certain that profitable bus lines could be operated in all of them. The through express bus service has not yet had its inning.

The rapid growth of our large cities, the tendency toward reduced street railway fares coincident with lapsing franchises, the consequent diminished earnings on investment, the crowded condition of the cars at critical hours of the morning and evening, the disinclination to

A 30 h p Bus Which Has Traveled Over 10,000 Miles at the Low Cost of $25 for Repairs. This Machine is an Old Pattern.

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buy more rolling stock or the inability to stable more with present barn equipment—all these things suggest that the city motor bus will eventually come into its own in our cities as in the cities of foreign countries.

But will they pay?

Go to London for the answer. There you will find a repetition of the old, old story. Some operating companies succeed where others fail. The lines which are well managed are very popular. What is popular usually pays.

In this connection it is interesting to note the firmness of the leading London motor bus companies in their determination to make as little use as possible of draft animal service. One of them, long the leading firm in horse bus passenger transportation, was recently reported to have become so dissatisfied with its machines as to resume the buying of omnibus horses. The rumor reached the ear of the head of the firm, who set it at rest by saying:

"There is no truth whatever in the rumor that we are buying horses to displace motors. In addition to our omnibuses, we have now quite a number of jobbing motors running, which we let out to private customers, and which are very successful, while we have also taken a further contract with the post office to convey parcels. We have been running every night, for over a year, to and from Brighton, and, with the exception of one slight mishap at the commencement, we have never missed a single journey. We have a large horse business, as you know, and are always buying for that, in order to keep it up to concert pitch, but we are not going back on motors."

The reply is strongly confirmatory of the profitable character of the work performed by motor vehicles.

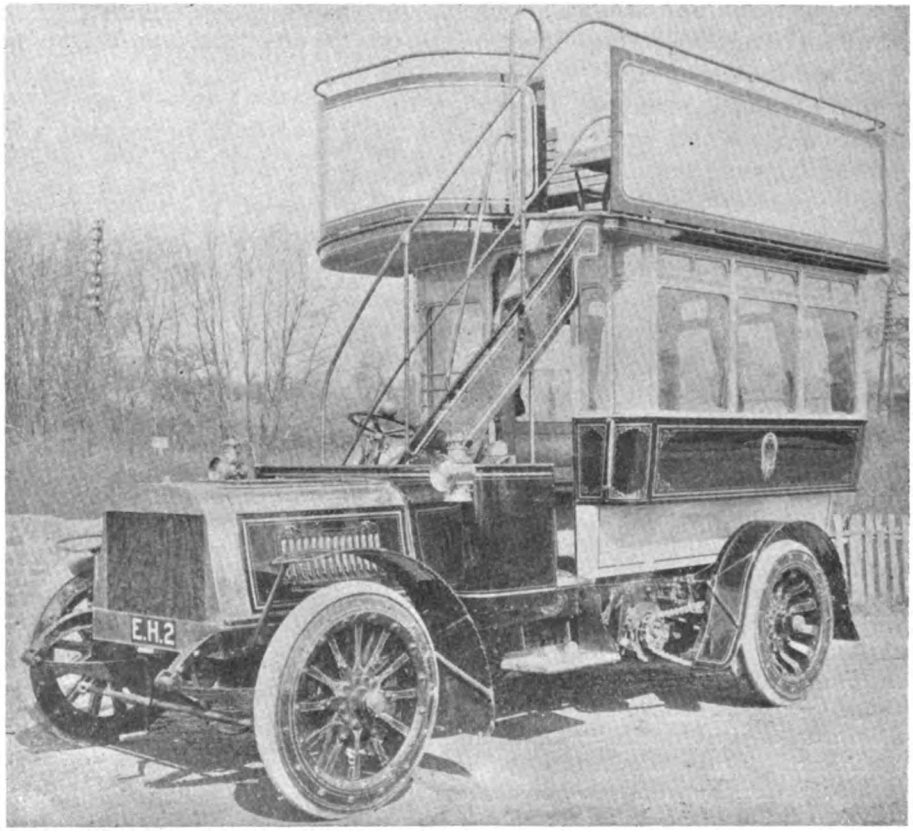
MOTOR BUSES IN MISSISSIPPI

REPORTS from Vicksburg, Miss., indicate that a motor bus line will soon be operating in the parks and cemeteries of that historic city.

Talk of a similar enterprise at Natchez has developed into something beyond mere speculation, as a syndicate of citizens has secured a big machine and are now ready to run regular trips between that city and Woodville. The enterprise will be given a good trial, and it is believed that it will be found to be of practical benefit and usefulness, even if not paying big dividends on the investment during the first couple of years. The railroad route between the two cities is too roundabout and indirect, especially when quick communication is desired, and river steamers are not always on hand, and it strikes the investors that quick and direct communication by machine over the dirt roads would be popular and profitable.

There is a plan on foot in Jackson to establish a motor bus line between the center of the business district and the manufacturing district of Duttoville, as the walking is not the best in the world, and the street railway extended lines do not tap the districts mentioned. There is a steadily increasing population in this district.

Having failed to secure permission to extend its street car lines in certain areas, the Berlin electric railway company has established five motor bus routes along streets which, though important channels of traffic, are not suited for street railway lines. The development of the Berlin motor bus scheme will be watched with considerable interest in this country, as the situation there is similar to that which prevails in many of our cities.



Bus Used in Pottery Districts Abroad; Entrance in Front; No Conductor Employed.

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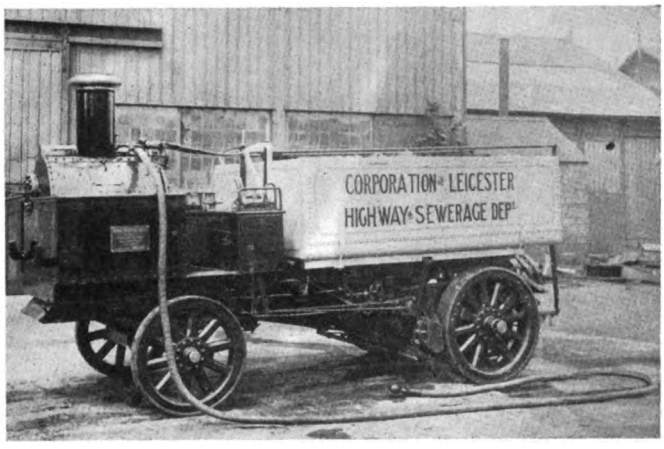
Municipal Motor Wagons

Concluding Portion of Paper Read by Municipal Engineer Before Contemporary Workers

ALTHOUGH the concluding remarks of Mr. Brodie, the eminent municipal engineer whose paper read before a body of contemporary workers has appeared by sections in this journal, do not possess the same large and general interest of his previous utterances, they are hardly less important on that account.

The authorities in almost every large city now cheerfully subscribe to the doctrine that heads of municipal departments, whose activities are not confined to the office, are greatly helped in the execution of their duties by being supplied with automobiles.



Steam Driven Municipal Watering Cart.

Very wisely Mr. Brodie points out that familiarity with the construction and operation of machines for passenger transportation will inevitably compel municipal officers to possess an intelligent understanding of what is required in order to suitably and economically maintain motor driven street cleaning machines, motor sprinkling carts, motor refuse hauling wagons, and motor propelled police and fire department vehicles. In all probability the lack of this experience has retarded the movement looking toward the universal employment of motor vehicles in all branches of municipal service.

Mr. Brodie's concluding thoughts upon the subject of municipal motor vehicles are here presented:

Scope for Speedy Municipal Motor Vehicles

There is great scope for the further utilisation of motor vehicles in connection with a surveyor's every-day work. They are of great advantage in enabling the surveyor to keep in close touch with the progress of the works, so that he may see for himself from time to time that the men under his charge are conducting them to the best advantage. They also enable him to make personal inspections promptly when required and to keep a check upon expenditures in a way which it would otherwise be impossible for him to do.

The author is, therefore, in favor of motors wherever such vehicles can show advantage over present methods, whether the improvement be in the direction of greater economy or of the more prompt dealing with such matters as affect the public health, and he considers that the successful road surveyor of the future will require to have an intimate knowledge not only of the action of such vehicles on the road surfaces, but also the effect of the road surfaces on the vehicles and their occupants.

He therefore advises the younger members of this association to acquire a practical knowledge of the motor by personally driving and maintaining where possible, as in this way the best knowledge is obtained, and without it it is very difficult to thoroughly understand the modifications which the fast motor requires in connection with road surfaces.

Road and Street Criticisms

Some points which have occurred to the author as objectionable in road surfaces when motoring are as follows:

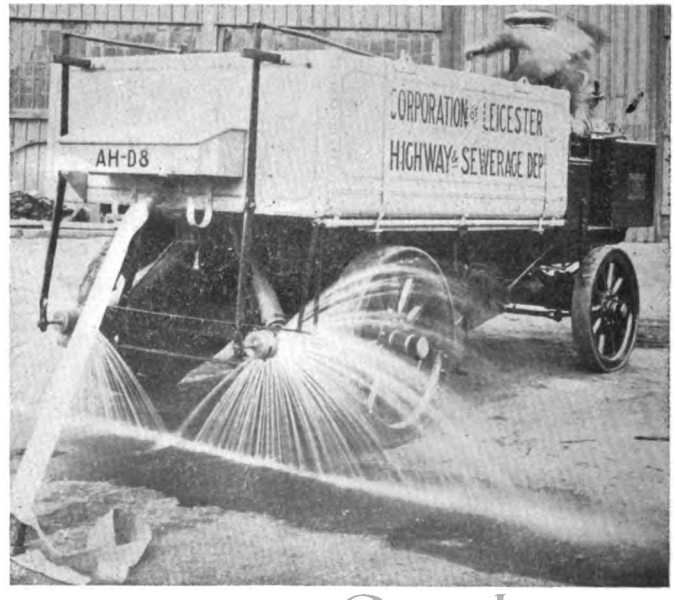
1. The abrupt endings of patches which are hardly noticeable with slow traffic and large wheels, but cause an unpleasant jolt if passed over quickly in a motor vehicle.
2. The excessive rounding of the sides of roads, practised in some counties, which tends to make the roads dangerous for fast traffic, especially in wet weather.
3. The crossfall to outside of quick curves, which drives fast traffic to keep the inside of the bend to obtain the super-elevation of the outer wheel, which means safety as compared with the danger of side-slip if taken on the outside.
4. The elevation of paved crossings and manholes above the surface of macadam roads, especially in towns and populous places.
5. The too sudden rise in the surface of the roadway over small bridges and culverts, which causes severe shocks and sometimes jumping of long wheel base cars.
6. The non-removal of loose stones, which in some districts are raked to the side once or twice daily, a great advantage to all users of rubber-tired wheels.

Suppression of Dust

As one who enjoys motoring on good roads and who has from time to time inflicted a considerable amount of dust upon the other users of the road, the author thinks it a great pity that no serious attempt has been made to tackle the dust nuisance from a point of view which automobilists might well be expected to take up.

Each time a fast car passes along a dusty road it puts a considerable percentage of the dust in motion, most of which settles down on the surface of the road to be again disturbed by succeeding cars.

If some of our automobile friends would tackle the dust nuisance by means of a fast vehicle in such a way as to enable



Steam Driven Municipal Watering Wagon in Action.

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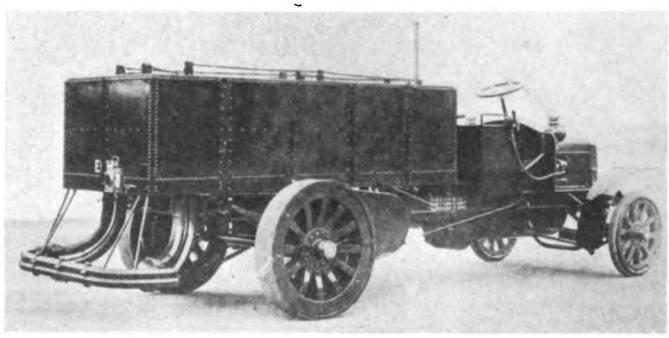
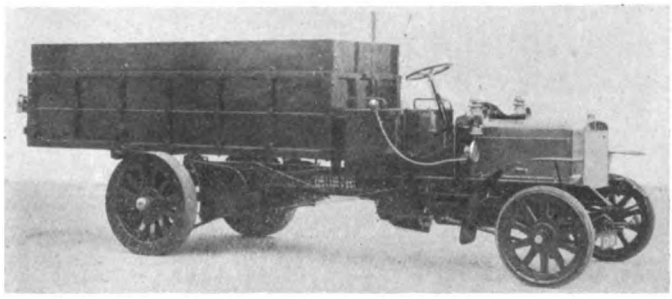
authorities responsible for lengths of main roads to satisfactorily remove all dust from such roads daily, they would be doing something to encourage the further extension of the automobile industry, and they would, I think, have little difficulty in finding a market for such an apparatus—as it appears likely that for some time to come many roads will continue to be made of the most economical materials available.



First Gasoline Municipal Watering and Refuse Collecting Wagon in England, Capacity 600 Gals.; Steel Tired Wheels.

While, therefore, it is clearly the duty of the surveyor responsible for roads to experiment with dustless materials, and to find, if possible, methods to prevent the dust from being formed, or when formed from rising, it is equally the duty of the motorist to do all that can be done by mechanical means to provide for the removal of the dust, if this be attainable, or to so design his



Same Wagon With Interchangeable Tipping Refuse Carrying Body; Capacity 4 Tons; 24 h p.

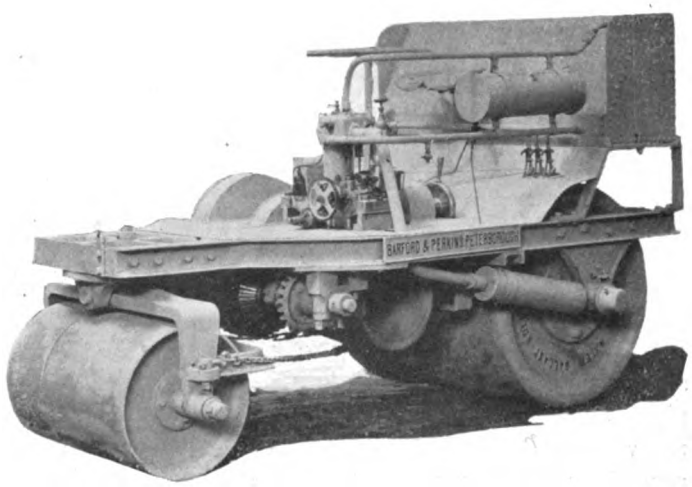
vehicle that its passage over a dusty road need not cause greater inconvenience than other vehicles to the general public, who are entitled to fair treatment on the public highways of the country.

GASOLINE MOTOR ROAD ROLLER

WE are all familiar with the smoky, noisy and cumbersome steam roller. The compact and quiet running gasoline motor roller, operated at less cost, now challenges its supremacy. The machine illustrated imposes a weight of 3 1-2 tons and is operated at a cost of 6 cents an hour for fuel. It is the latest product of the firm which is known as the largest makers of rollers in the world.

The new type of roller has a bridge spanning the front rollers which allows oscillation in mounting stones or other obstructions without affecting the level of the main frame and practically isolating it from torsional strains. A pulley can be fitted in order to render the power externally available for driving other machinery to which it can be connected by belting, such as pumps, dynamos, etc. The machine is well suited for work on park grounds, golf courses, roads and private estates. Its cost is $1,000.

The hind roller of the machine, which is water ballasted, is made of hard cast metal. The outside edges of this and of the front rollers are well rounded off. The channel iron frame is stiffly braced, the forepart being coupled to the front rollers by a steering head and bridge. Springs are used over the rear axle to minimize vibration and strain on the frame. The single cylinder of the motor is water cooled. The circulating tank is placed over the hind roller. Its weight is in a useful position. At the same time its height renders a pump unnecessary, the circulation being automatic.



Two speeds, either forward or backward, are provided, the machine traveling at a rate of either one mile or three miles an hour and the change being conveniently made from the driver's seat. Of course, by varying the number of revolutions made by the engine intermediate speeds can be obtained. The steering is extremely easy, the driver having perfect control through the hand wheel in front of him, which is connected by means of a chain to the steering head.

A motor bus is operating between Ripon and Green Lake, Wis. The route includes Dartford and the principal hotels on the lake.

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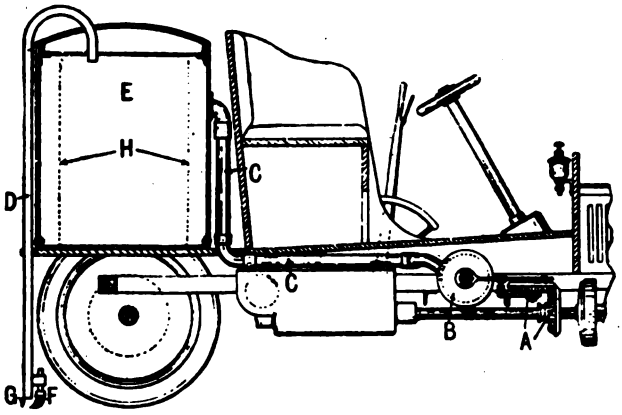
Recent Inventions

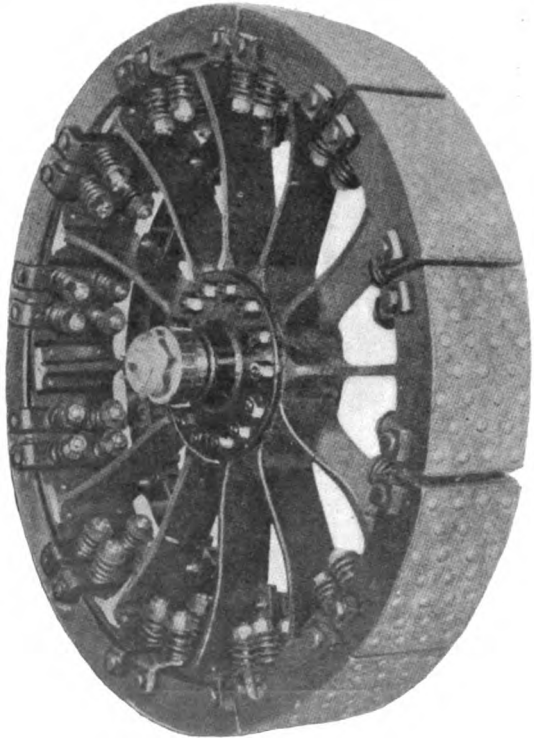
THE motor driven dust collector shown in the accompanying illustration is intended to suck the dust from the road and collect it in a receiver. The engine drives, through gearing A suitable fans or pumps (one of which, B, is shown, arranged across the vehicle), which can be put into or out of gear as desired. These pumps draw



air along the pipes C D, and through the receiver E. The pipe D reaches almost to the road surface, and extends the whole width of the car. In front of the pipe is arranged an agitator, which takes the form of brushes F, and behind is arranged a screen G. In the receiver E is a filter H, which causes the dust to be left behind while the air passes through the pumps and is exhausted.

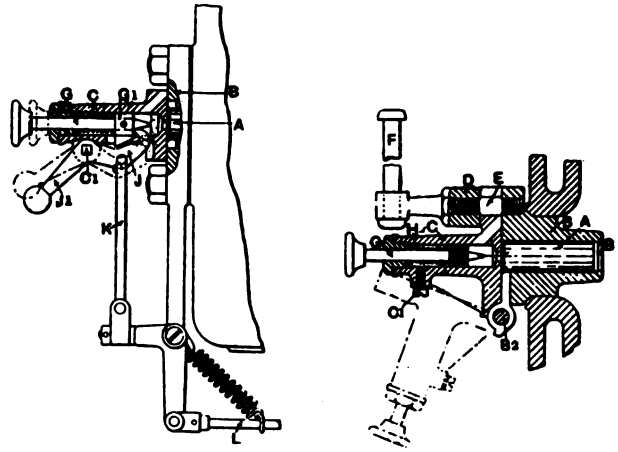
Wheel for Heavy Wagons

The wheel shown is intended for use on very heavy wagons. It is built with a steel hub, carefully turned and bushed, and has cast or wrought steel spokes and steel slippers. These slippers are covered with studded leather or some material of similar quality. The slippers give to all unequal angles of roadway and to stones or other obstructions, thus taking undue stress off the axles of the vehicle. The springs are so arranged as to work in unison with the hub center, causing the surface of the slipper always to meet the road horizontally and fairly, irrespective of uneven surface.

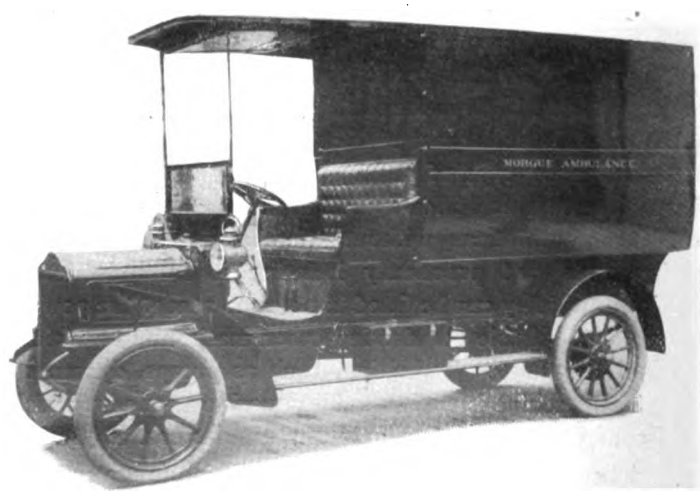


Cartridge Starting Mechanism

This mechanism is adapted to be attached to engines and enables them to be started by the firing of a cartridge in one or more cylinders. The cartridge A is placed in a chamber in the block B which communicates at its end with the combustion chamber. On the block B is pivoted a breech block C, held in place by a nut. By slackening the nut by means of the handle F, the breech block can be turned about its pivot, into the position shown by the dotted lines, to enable the cartridge to be inserted. In the breech block is arranged the firing needle G, which is adapted to strike the cartridge under the influence of



the spiral spring H. Engaging the firing needle—or, rather, a block thereon—is a sear or detent J. This is pivoted on the breech block, and provided with an extension, enabling it to be operated by hand. The firing needle is drawn back and held in place by means of the sear, and released when necessary by tripping the sear. The sear is connected up by the rod K to the magneto ignition mechanism L, so that it may be worked automatically if necessary.



Steam Driven Morgue Ambulance Used in Pittsburg.

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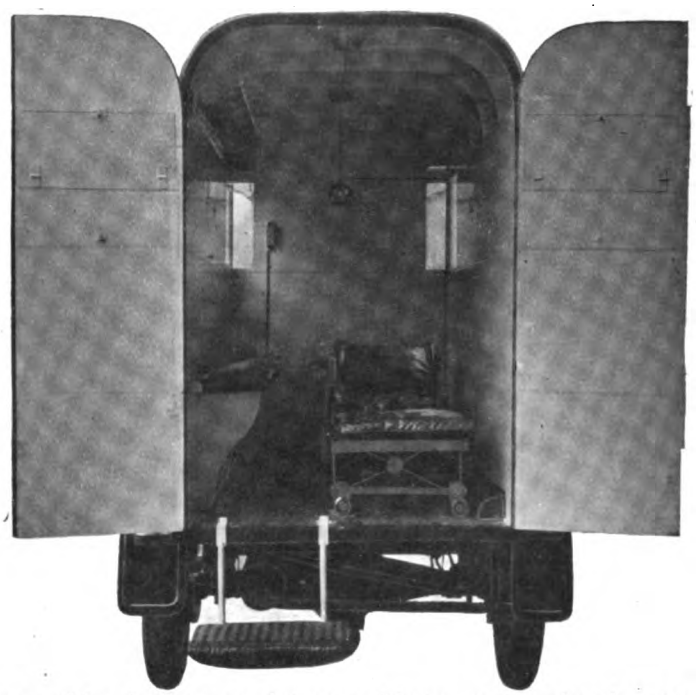
IMPROVED MOTOR AMBULANCE

SOME new and useful features of construction have been incorporated in a motor ambulance built to the order of a Scotch hospital. The body has been designed to afford as much comfort as possible to the patient. Numer-



ous rubber buffers are interposed between the chassis and the main frame to insulate it from jars. The heating of the interior is accomplished by means of the exhaust from the engine, which escapes to the atmosphere through a pipe fitted on the floor in the interior of the body. This pipe is separated by means of a by-pass valve from the main exhaust pipe and through it a regulated volume of exhaust gases pass. The wheel base is 132 inches. The wheels, of artillery type, are exceptionally strong. The top speed of 20 miles an hour can be accelerated to 28 miles per hour.

The power from the engine is transmitted by means of a worm and worm wheel. The springs are exceedingly flexible. The flywheel and clutch are combined, the clutch being composed of multiple metal discs running in oil. Adjustment of the clutch can be made from the outside when necessary.

A PIANO MOVER'S TRUCK

THE George E. Dewey Company, of Hartford, Conn., doing a general trucking business and making a specialty of piano moving, is employing a Knox truck to advantage. Recently a run was made from Hartford to Springfield, 26 miles away. The load each way was four pianos and three men. The performance on this 52-mile round trip was very satisfactory. Another run was made to Meriden with three pianos, the round trip being some-

thing like 44 miles. Two round trips were made to Bristol on another occasion, a total journey of 72 miles.

The manager of the concern figures the machine will do the work of at least two horse teams and do it every day in the week. "We are saving money by using the truck," he says. "It takes less time to do a job. That means less time for the working crew who, working by the hour, would cost us more when using a horse team. We anticipate that the truck will soon pay for itself."

The owner of a poultry farm near Buffalo employs a gasoline wagon to haul his fowl to market, making three trips a week. The broilers are prepared for market the day before they are transported, put in cold storage on the farm, and an hour or so before the market opens are forwarded by power wagon.

The Association of Municipal Cleansing Superintendents of Great Britain has decided to send delegates to Milan, Italy, to watch the trials of motor vehicles for cleansing purposes, and for heavy motor traffic generally.

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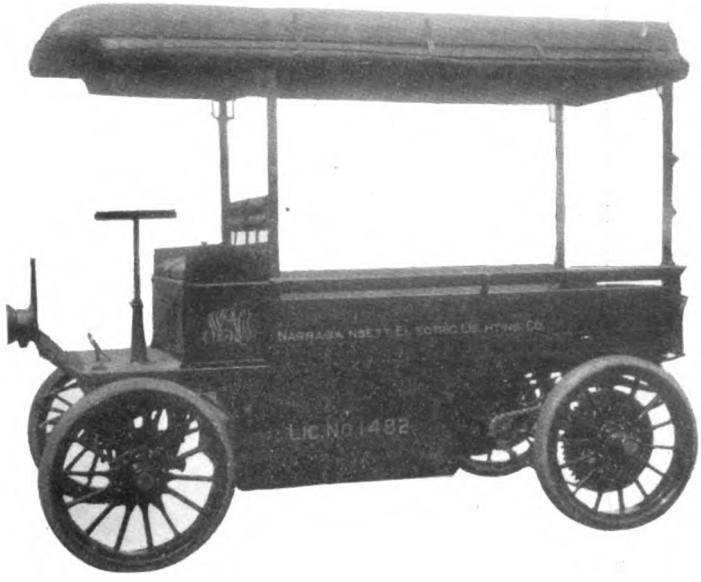
WAGONS IN LIGHTING COMPANY'S SERVICE

FOUR electric wagons are employed by the Narragansett Electric Lighting Co., of Providence, R. I. One machine, although designed for trimming arc lamps, is chiefly used for construction work. Another, of the same type as used by the Adams Express Company, is used in the company's arc lamp department for carrying inner



globes, etc. The third machine is at the service of the installation department, which installs and removes meters and incandescent lamps.

The fourth wagon, also used in the installation department and shown in one of the accompanying pictures, was purchased two years ago. It was the satisfactory service rendered by this machine which induced the company to purchase other vehicles of its kind. The structural features of this wagon are as follows: Wheel base, 68 1-2 inches; wooden wheels; solid tires; height of floor from ground, 26 inches; capacity about 750 lbs.; two motors, series wound, 85 volts, 16 amperes, 3 1-2 hp. maximum each; wheel bearings, plain; motor bearings, ring oiled; mileage per charge, 40; three speeds; running current, 25 amperes on level; battery cells, 40, capacity, 112 ampere hours, 28 ampere rate.

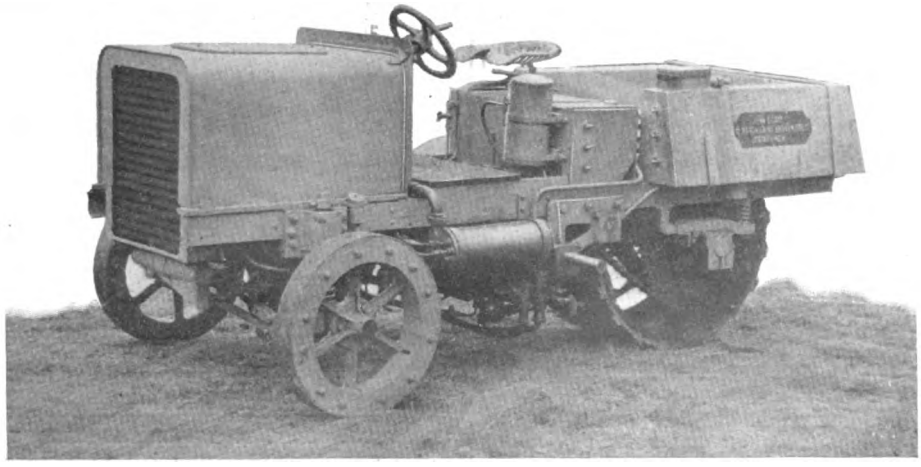
MOTORS IN EGYPT

ALTHOUGH at present commercial motor vehicles are necessarily scarce in Egypt the demonstrated advantages of those in actual service is a fairly reliable indication that before long they will be extensively employed, not merely in city merchandise and passenger transportation, but even for freight shipments over the desert roads adjacent to or linking the principal cities.

It has already been stated in this paper that Cairo has a motor bus company, capitalized at $500,000. This company now operates four machines and will soon put eleven more in commission. The municipal sewage wagon of Cairo has also been described and illustrated.

Now the government is using motor wagons and cars in the police inspection service in the desert region lying between Edfur and the Red Sea, the gold-mining country which is now being considerably exploited. The desert offers almost natural roads, and it is estimated that it will cost only from $5 to $10 per mile to make them perfect. The experiment has succeeded well so far, and police inspection, formerly made on camels and consuming for each trip six weeks, can now be made in two weeks. The main obstacle the machines encounter is the drifting sand and the heat.

Machines for the Soudan, according to the word of our consul at Cairo, should be equipped with powerful engines, metal wheels, very efficient radiators and large fuel tanks. All working parts should be effectively protected against sand. For the eastern desert district the vehicles should be lighter and be capable of pulling a trailer.



Agricultural Steam Tractor for Plowing, Hauling and Driving Barn Machinery.

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Manufacturers do not evince enough interest to enter their vehicles. Various reasons are assigned for this indifference. The majority do not believe that the economy, durability or reliability of the machine in commercial service can be demonstrated in traveling 40 miles a day for four days with picked loads. Vigorous protests are registered against the right of the Automobile Club of America to formulate rules by which power wagons may be judged in this or any other contest. Only one firm has signified an intention to compete.

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Study of American and European methods employed to obtain high service-efficiency. The European practice of thoroughly overhauling and rebuilding machines at regular intervals throughout the course of the year, in order to guarantee that road efficiency shall be at par, is contrasted with the American practice of delaying overhauling and rebuilding as long as possible by continuous repairs, which, though affording momentary relief, results in the service efficiency of the vehicles being low.

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Good pavements tend to greatly reduce the cost of power wagon maintenance. Bad pavements are costly to the tax payers and inadequate for any kind of road vehicle transportation. Description and illustration of a durable, waterproof, silent and economical wood block pavement which is extensively used in New York City.

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The unreliability and slowness of horse-drawn ambulances make them inferior to motor ambulances, though the maintenance cost of the latter may be greater, comparing one machine with one horse-drawn vehicle. The unsanitary horse, however, gives offense to hospital economists. Experience with motor ambulances in New York hospitals.

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It is believed that this projected amalgamation, which it is said will be capitalized at $10,000,000, is the forerunner of a still larger one which will include all of the giant operating companies.

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POWER WAGON DATA

PERCENTAGES OF REPAIR EXPENSE:

Battery renewals and repairs	52 %
Tire replacements	34 %
Gear and pinion renewals	6 %
Other mechanical repairs	5 %
Motor, controller and wiring repairs	3 %
	100

If a battery is obtained that will considerably reduce the largest item of expense, then electric trucks and wagons can be run much more economically. The Gould Battery saves from one-half to two-thirds of the cost of battery maintenance. This means that by using it you will save 26% to 35% of your total truck and wagon repair bills.

The Gould Storage Battery Co., have issued some interesting bulletins on present installations. Their main office is 1 West 34th Street, New York City.

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The Power Wagon

A Journal for Those Employing Commercial Motor Vehicles

VOL. II NOVEMBER, 1906 NO 3

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WALTER WARDROP, EDITOR

Entered as Second-Class Mail Matter at the Postoffice at Cleveland, Ohio, Under the Act of Congress of March 3, 1879.

Foredoomed to Failure

Motor Wagon Contest, Announced to be Held in New York Next Week, May be Abandoned

ENOUGH evidence is already before us to prove that the four-day motor wagon contest, announced to take place next week in New York under the jurisdiction of the Automobile Club of America, is foredoomed to failure. A few vehicles may be operated over the prescribed routes, but it would be rank folly to pretend that their trivial performances will be widely accepted as conclusive evidence of economy, reliability and durability of the power wagon.

If the contest is indefinitely postponed no one will be greatly surprised, for the club is not in position to endure the harsh criticism which would inevitably follow such a ridiculous spectacle as a competitive event, advertised as of national industrial importance, turned into a farce for the delectation of street gamins. Doubtless the club has its pride and will not permit the contest to take place.

If, however, in the face of the disinclination of the most reputable manufacturing concerns to participate, the club persists in its intentions, it is absolutely certain that the functions it has usurped will be seized by a body having a much higher interest in the demonstration of the economy and utility of the power wagon than any automobile club in America. There is no veiled threat in this remark. It is merely the expression of opinion which is current in circles where power wagons are used and made.

* * *

Representative manufacturers refuse to be inveigled into the contest, which promises nothing than the award of a silver cup. They disdain to compete for a trophy which cannot by any stretch of the imagination be held to represent the economic or mechanical superiority of the winning vehicle. Everybody knows that in brief demonstrations, such as are proposed under the rules governing this contest, the honors might easily fall to a machine which, though emerging with brilliance from the competition, for one reason or another would be unable to live through a single year of actual commercial service. The reliability and durability of a power wagon is not proven by parading 160 miles—forty miles a day for four successive days—with loads selected at the pleasure of contestants. To be sure the uninterrupted performance of such a journey is an indication of the vehicle's fitness for service, but so feeble a measure of it as to be unconvincing to the mass of buyers.

* * *

As a test of the faith which the Automobile Club of America reposes in the value of this contest we may be permitted, on behalf of prospective buyers, to ask these questions: Will the club give a bond to guarantee that the wagon which is awarded the glittering trophy will be in fit condition to hold the road one year from date? Will it go in pawn for the economic performance of the vehicle during that period? Or, if these proposals savor of harshness, will the club enlighten the world, out of its plentitude of knowledge upon the subject, what is the relative value of power wagons and draft animals in all the infinite varieties of city merchandise transportation. If it will do any or all of these things it will confer a distinct benefit upon industry and justify general acclaim for its enterprise.

It is not necessary, considering the thousands of power wagons now in use, for the club to ceremoniously tabulate electrical energy, fuel and lubricant costs in operating electric, gasoline or steam vehicles over a measured course. Even if the club had all the available information

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upon these items of expense, its presentation would be of small value in view of the fact that the economy of a power wagon is seldom if ever determined by expenditures of this kind.

* * *

The economy of the power wagon rests almost wholly upon the saving which is to be accomplished in wages as a result of the employment of less transportation units than are required in draft animal service. The Automobile Club of America—and many another fussy organization like it in other countries—usually fails to grasp the significance of this statement, and as a result is always on hand with minim glass and yard stick to see if some laboratory conclusion is to be supported or rejected.

It really doesn't make a particle of difference whether the fuel or lubricant of a power wagon costs a few dollars more or less every month; in fact, in actual practice these costs will be found to vary according to the expertness of the drivers who are employed to serve the vehicles and the hours of service.

* * *

In the maintenance of a power wagon the biggest individual item in the accounting is always the expense for tires. An economy test which did not take note of tires would be as absurd as a performance of the play of Hamlet with the services of the splenetic Dane missing. The Automobile Club of America has made every preparation to measure gasoline and lubricant, doubtless with the idea of estimating bare operating costs, but has not deemed it worth while to gauge the larger and more important item of up-keep. One of these days the club, departing still further from its lawful work, will doubtless be observed measuring bricks with a micrometer in order to ascertain what progress is being made in architecture.

* * *

The stupidity which prevailed at the time the rules for this contest were being formulated must inform even the most casual observer that the club is unfit to have charge of such an event. Rule 6 provides:

"Each contestant shall furnish his own dead load, consisting of whatever material he may see fit to carry, which will be weighed and checked by the contest committee."

Are we to understand from this that the contest committee does not distinguish between the character of loads, or recognize the important bearing their variety exerts upon vehicle maintenance? Could a vehicle constantly operated with a five-ton load of feathers be expected to show the same wear as one operating with five tons of lumber, or pig iron, or sand, or heavy boxes of dry-goods merchandise? Everyone accustomed to studying the problems of road vehicle transport is well aware of the different effects produced by "live" and "dead" loads. Besides, some merchandise, being bulky, necessitates an overhang on vehicles, which in turn causes excessive wear on tires and subjects the rear portion of the wagon to great strains in skidding. It is unnecessary to proceed further with this analysis. It is plain that Rule 6 was prepared by an incompetent.

Rule 5 provides that all vehicles, whether electric, steam or gasoline, shall operate in the same class. Doubtless it was intended by the framers of this provision that all three types should be put upon a plane of equality. That may be so in theory, but in practice it is very far from being true. The comparative economy of an electric vehicle is not disclosed in operating over a measured course in competition with steam or electric machines. Its principal advantages are only discovered when it is employed in considerable numbers, it then being found that stable administration costs are heavily in its favor.

But in such an absurd contest as is proposed, the electric machine would not need to take shelter behind such pleading. It is altogether probable that for four days' work its bare operating costs—repairs, electric current and lubricant—would be less than for any other type of power wagon, particularly if the batteries were charged in an establishment where advantage could be taken of the actual cost of producing electric current, a convenience, by the way, by no means uncommon.

In its clumsy attempt to give equal opportunity to gasoline, electric and steam vehicles the club has only succeeded in confusing the public. Evidently the club does not distinguish between mechanical opportunity and economic opportunity, or imagines that the two are twin in spirit and meaning.

* * *

Official observers, functionaries who have come to be necessary in ceremonies of this kind, are to represent the brain and majesty of the club on each contesting vehicle. These officials will be expected to pay strict attention to the performance of the vehicles, the fuel, water and lubricant consumption, and no repairs will be permitted without their knowledge. It is surprising that the vigilance which impels the club to attach a representative to each competing vehicle should not extend to the driver who, so far as we can discover, may be a factory expert and as different from the operator found in commercial service as chalk is from cheese.

* * *

Rule 12 assures contestants that gasoline, kerosene, fuel oil of whatever sort, electric current, coal and coke, used for generating power, will be accurately measured and charged against each vehicle. The cost of adjustments and repairs, figring repairs at 50 cents an hour and repair parts at retail prices, will also be charged against the vehicle. From the sum of these operating and repair costs the cost of operation per ton mile of paying load will be ascertained.

This solemn pronouncement is very amusing to those who realize that in a service of power wagons the cost of operation per ton mile may be exceedingly low and yet the ledger might make a very unsatisfactory showing. It is the gross cost of operation which determines the economy of the power wagon. To calculate exclusively upon the cost per ton mile is an academic way of dismissing an exceedingly complicated subject. If stable costs are higher than they should be, it will be small consolation to know that road operating costs are quite low.

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It is difficult to understand why labor expended in effecting casual repairs should be charged at the rate of 50 cents an hour, unless it is the vicious intention to show that the cost of power wagon maintenance is greater than it is really known to be. The majority of repairs are effected by drivers who are regularly on the pay roll. Further than this, the majority of concerns operating power wagons buy spare parts not, as Rule 12 would lead buyers to imagine, at retail prices, but at a low price mutually agreed upon at the time machines are purchased.

* * *

It is now time to show the interest which manufacturers take in the proposed contest. One would think the club would have taken the precaution to ascertain beforehand if the co-operation of power wagon makers could be obtained in an event of so much importance. A more sympathetic and less arrogant organization than the A. C. A. would at least have deemed it courteous to inquire if the people who have to "pay the freight" were willing to play their part in making the contest a success. The club, however, has grown accustomed to projecting enterprises and leaving their development to people with commercial interests to be served. This time, however, the club has made a sad miscalculation. Manufacturers will have nothing to do with the contest. Some are too busy selling machines; others are unwilling to bear the expense of competition; the majority, however, are of the opinion that the contest will be flat, stale and unprofitable. See what they have to say upon the subject:

A Vigorous Protest

We shall not enter the contest. We do not consider such contests of any practical value to the prospective users of power wagons. We prefer to make our own investigations and tests

We do not believe that the Automobile Club of America should undertake to hold such contests or make awards, as they are not sufficiently informed and have not had enough experience to guide them in the formulation of governing rules and conditions; beside which we believe that the club is going entirely out of its province in doing so. We think it should have nothing whatever to do with the automobile business either in the matter of shows or tests. Its efforts to promote automobile racing are praiseworthy inasmuch as that is a species of entertainment.

In general, it is our opinion that commercial power wagons of all kinds are being tested all over the country under conditions which will aid in the development of better wagons and at the same time demonstrate their utility to people who are interested in the solution of transportation problems.

We are very glad to learn everything possible as to the comparative merits of various forms of power and modes of construction, but we do not expect to learn anything from the forthcoming contest and do not expect that the conclusions of the club on this subject will be of any value to us

Further than this, these tests are likely to be very unfair, inasmuch as they cannot possibly take into consideration the cost of operation or reliability of service over a long period of time. A wagon that might make a very good record in such a test may be worthless for all practical purposes.

We also think that these tests, if they become frequent, would prove a nuisance to manufacturers for various reasons, besides the expense which they would be obliged to bear.

It seems to us that a manufacturer of locomotives would at once resent an effort of the Engineers Club of New York to compel him to enter his locomotives in a test carried on by that club. In the case of business wagons the manufacturer has all the more reason to object as they are built for a great variety of purposes.

The attempt to include all power wagons in a few classes is evidence of the lack of familiarity on the part of this club's committee with the problem of trackless transportation. There are so many variable factors in the problems with which every public or private carrier has to struggle that it is nothing short of ridiculous for the Automobile Club of America to set up standards for the trucking business.

The promotors of this contest seem to think that it is the public which desires information on this subject, rather than the manufacturers. In reality it is of much greater importance to the manufacturers, and if they have no confidence in the results of such contests it is hardly worth while for the public to be misled by them.

We have raised these objections before with the gentlemen who are back of this effort, and they always seem to think that we might be afraid of the disparity in results between gasoline trucks and the electric wagons which we are building. This is not the case. We believe there is a field for both electricity and gasoline, and we want to build the best wagons for various uses regardless of prejudice in favor of any motive power.

We desire to satisfy ourselves as to the capabilities and possibilities of the several modes of propulsion and build those which seem best to meet the requirements. It is immaterial to us whether gasoline is better than electricity for any particular purpose. If it is we want to know it and shall advocate it, but we should not be satisfied with a four days test of the kind proposed.

Long Island City, N. Y.

GENERAL VEHICLE COMPANY.

* * *

Trials Should be Conducted by Makers and Users

We will not participate in the motor wagon contest to be held in New York City from November 7 to 10. Some of our reasons for not doing so, are as follows:

First: We do not believe that any benefit is derived by the motor truck manufacturer from public contests conducted by automobile clubs or associations, as they do not demonstrate to the prospective purchaser what the truck will do in his particular business and locality.

Second: Any misfortune with which a contestant might meet in this public contest would act against him, though it would be no criterion for judging of the service which one of his vehicles might render in actual daily service. On the other hand, the success of any one vehicle in this contest does not mean that it would give satisfactory service under various road and other conditions in various parts of the country.

Third: It would seem that, to get the best results from a test of this nature, the governing conditions should be arranged by a committee composed of both extensive users and manufacturers of motor trucks.

Fourth: Contestants should be divided into classes, it being a well known fact that a motor truck suitable for heavy delivery service will not meet the requirements of heavy trucking.

Fifth: We do not believe that the cost per ton mile of operation of all vehicles is the proper basis on which to award prizes, the factor of time being an important one.

Sixth: Should a contestant be successful in one of these contests, that fact alone will not sell vehicles for him, it being necessary to demonstrate to the prospective purchaser that the vehicle will do the work in his individual case in a satisfactory manner.

There are many other reasons beside those noted above, but with us those mentioned are sufficient to prevent our entering the contest. We believe that the Automobile Club of America is to be commended for its efforts and interest in the motor wagon, which is destined to become one of the greatest departments of the automobile business and take an important part in the industrial development of the country.

Detroit. RELIANCE MOTOR CAR CO.

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Stipulating for Equality of Competition

We consider the contest proposed a very desirable one provided it is run upon a basis of competition that makes it fair to every participant. But unless the principal manufacturers of the country engage in such contest, it would be a hollow victory for those who did compete. Unless the principal manufacturers can be convinced that the competition will be entirely fair to all, and will be conducted by officials who are fully qualified to judge the merits and the performances of the individual cars, then it would certainly be prejudicial to the best interests to conduct the contest. We would gladly enter a properly conducted contest, and believe that it would, if participated in by 75% of the makers, be a tremendous benefit to the industry and promote the interests of all of us.

Under the rules which governed the efficiency contests during the past season, a single cylinder motor has not a shadow of a chance to win. We are willing to go into any contest which would put us on a basis with two and four cylinder cars, but it is useless to work against the handicap imposed on the single cylinder cars under the present methods. The committees governing these tests evidently overlooked the fact that some of the cars can cut out from one to three of their cylinders and do the work of a single or double cylinder car without suffering the handicap.

Waltham, Mass.

WALTHAM MFG. CO.

* * *

Useless so far as Buyers are Concerned

Our opinion of the proposed power wagon contest in New New York City is that it will be entirely useless so far as interesting prospective buyers and determining the economy of the wagons is concerned. An experience of several years with the power wagon has convinced us that such a contest will not appeal to the class that buys power wagons, and for this reason we shall not participate in it.

Springfield, Mass.

KNOX AUTOMOBILE COMPANY.

* * *

Will not Participate in the Contest

We shall enter no vehicles in the proposed power wagon contest to be held in New York City. We are not fully satisfied as to the value of such tests, although, of course, they cannot fail to be of considerable use.

Hartford, Conn.

ELECTRIC VEHICLE COMPANY.

* * *

Will Not Enter the Contest

We shall not participate in the motor wagon contest to be held in New York City from November 7 to 10. Our reason for this decision is that we are unable to spare any wagons for the purpose from those on order for delivery to customers.

South Bend, Ind.

STUDEBAKER AUTOMOBILE COMPANY.

* * *

Will Not Participate

We will not participate in the motor wagon contest to be held in New York City November 7-10.

Hartford, Conn.

POPE MANUFACTURING COMPANY.

* * *

A Waste of Good Money

We are not in favor of power wagon contests of the kind proposed. The money they cost could be better expended upon design and construction, investigation of traffic conditions, and in giving service demonstrations. There is nothing to be gained from such contests, for the wagons are not always representative of the stock manufactured, while the drivers are experts who know how to avoid repairs and keep the machine moving with the least expense for fuel, etc.

Chillicothe, Ohio.

LOGAN CONSTRUCTION CO.

* * *

Hopeful for Benefits, But Will not Compete

It will be utterly impossible for us to enter the power wagon contest in New York City from November 7 to 10. However, we feel that it will be watched with a great deal of interest by the users of commercial vehicles throughout the country. The result should be of advantage to those contemplating the purchase of power wagons.

Lockport, N. Y.

AMERICAN MOTOR TRUCK CO.

* * *

Unable to Participate

We will be unable to participate in the four-day power wagon contest to take place in New York November 7 to 10.

Detroit.

AMERICAN MACHINE MFG. CO.

* * *

A Fundamental Difficulty

We will not enter any of our vehicles in the contest. We do not wish to discourage tests of this kind, as we believe that they are valuable. Of course the hardest proposition in a test of this kind is to get rules whereby all the vehicles shall be working under equal conditions. If this is done the test will necessarily be valuable.

Tarrytown, N. Y.

MAXWELL-BRISCOE MOTOR CO.

* * *

Will not Compete, but approve of Contest

We will not enter any vehicles in the contest to be held in New York from Nov. 7 to 10. We consider these contests thoroughly practical and of great use in demonstrating the efficiency of the power wagon. We believe the Automobile Club of America is, or should be, thoroughly competent to handle such contests. They have had a great deal of experience with automobiles, and the personnel of the committee is such that we think any contest they hold will be conducted in an impartial and thoroughly business-like manner.

Sandusky, Ohio.

HINDE & DAUCH.

* * *

One Firm Ready to Compete

We shall have one or more trucks in the motor wagon contest to be held from November 7 to 10. We believe this to be an exceptional opportunity for manufacturers of commercial vehicles having confidence in their product. It affords them an opportunity to bring it before the public and demonstrate in a practical way the value of the self-propelled vehicle over the horse drawn.

Springfield, Mass.

KNOX MOTOR TRUCK CO.

* * *

Properly Conducted Contests are Stimulating

We will not be in position to enter any of our trucks in the contest held by the Automobile Club of America. We certainly believe that contests conducted right will have a stimulating effect upon the buying public and will at the same time force the manufacturer to build power wagons to suit the needs of the buyer.

Sheffield, Mo.

KANSAS CITY MOTOR CAR CO.

* * *

Judgment Suspended

We shall not enter any of our vehicles in this test, as we are making some changes which, if successful, we desire to incorporate

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in our future output and which we want to fully test before placing before the public. As to the usefulness or uselessness of such a contest, we prefer not to express an opinion until we have had opportunity to examine the results obtained from the one forthcoming.

Philadelphia.

BARBER ASPHALT COMPANY.

* * *

Too Busy to Bother With Contests.

In view of the pressure of business at the present time, and the nearness of the December show, we will not enter the event.

Newark, N. J.

THE LANSDEN COMPANY.

* * *

Prefer Service Demonstrations

We do not wish to enter our machine. We cannot see any advantage in a contest of this kind. We prefer to demonstrate the practicability of our machine under conditions where it is to be used.

Milwaukee.

FOUR WHEEL DRIVE WAGON CO.

* * *

Contest Will be of Small Value

We do not intend to place any vehicles in the contest being promoted by the Automobile Club of America. While there is, no doubt, a general publicity value to affairs of this kind, we do not believe the club can conduct a contest which will be of much value in inducing business firms to investigate. We believe that each firm desires to make its own tests in actual business service, running the wagons over streets which actually have to be traversed and hauling their own freight.

Racine, Wis.

MITCHELL MOTOR CAR CO.

* * *

Merits of Machines Will Not be Established

While we do not believe that such a contest will establish the relative merits of the machines entered, we nevertheless feel that tests of a public character of this sort, even though the rules and conditions may not be equally favorable to all of the machines entered, add largely to a general fund of information which conservative business houses in this city, at any rate, desire to have at their disposal before installing automobile transportation and delivery systems.

New York City.

THE COMMERCIAL MOTOR CAR CO.

CONDITIONS OF MOTOR WAGON CONTEST

DURING the four days of the A. C. A. motor wagon contest, announced to be held in New York from November 7 to 10 inclusive, such vehicles as put in an appearance will be expected to cover the following 40 mile course every day:

FIRST STAGE

From Club House, at 58th street and Fifth avenue, to Ft. George, Washington Bridge, Jerome avenue, Seventh avenue, to Club House .....20 miles

SECOND STAGE

From Club House to the Battery and return. ..... 10 miles

THIRD STAGE

From Club House to the Battery and return ..... 10 miles

Total, ... 40 miles

Each entry costs $25. The time set for receiving entries expired on November 1.

Vehicles are to be stored over night at the depot provided by the club. They will be delivered to the custody of the club's representative at the end of the first day's run and remain in his care until taken charge of by the official observer on the morning of the second day.

On the first day of the contest each vehicle(fully loaded) shall cover the route prescribed without stops, except those that are involuntary.

On the second day each vehicle (fully loaded) shall cover the same route traveled on the first day, and will be required to make certain specified stops to be decided upon by the club.

On the third day each vehicle (without load) shall cover the same route as on the preceding days without stops, except those which are involuntary.

On the fourth day each vehicle (without load) shall cover the same route as on the preceding days, and will be required to make the specified stops.

RULES FOR MOTOR TRUCK DRIVERS

IN the stable of one of the largest users of electric trucks in the country the following rules are conspicuously posted:

1. No driver shall overload his truck without special order.

2. Drivers running down grade shall not go any faster than the speed of the machine when on the level.

3. All drivers required not to stop with load, going up steep grade.

4. Pushing or moving railroad cars with automobiles not permitted.

It is scarcely necessary to say that the trucks owned by this concern do not waste their stored energy or cause unnecessary maintenance expense through overloading and speeding.

CO-OPERATIVE MOTOR WAGON GARAGE

A co-operative organization, known as the Heights Garage and Storage Company, has just been incorporated to do business in New York City. The capital of the concern is $150,000. Patrons of the establishment will be stockholders.

A building 345 feet long and 65 feet wide, extending from Riverside drive, near 161st street, is in course of construction and will be ready by January 1st. It is planned to provide special equipment and facilities for caring for motor wagons. This class of trade will be induced on the ground that storage for vehicles in the upper section of the city can be more economically provided than downtown, especially for machines which traverse routes in the upper part of the city.

The officers, well known business men of New York, are as follows: President, P. H. Fowler; vice president and secretary, Wm. J. Weller; treasurer, A. L. Smith.

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Periodic Rebuilding

High Service-Efficiency Cannot be Obtained by Present Administrative Methods

AMONG the many problems which disturb the equipoise of motor wagon owners none is more fascinating, more elusive, or more perplexing than the means to be employed for maintaining high service-efficiency. As this efficiency depends upon the skill exhibited in administration, it will be interesting to compare the executive methods which prevail in this country with those which are practiced abroad. The study will not be flattering to American pride, as it will show that adhesion to American methods is attended with marked disadvantages, not the least of which is a needless waste of labor and money in effecting repairs.

Strictly speaking there is no well defined American method for maintaining service-efficiency at a high point. Each concern employing power wagons develops its own system. Certain fundamental practices are common to all, such, for example, as superficial examination, light repairs and adjustments. If we might denominate American practice for the maintenance of high service-efficiency by a term which would express the methods which have the greatest vogue, we would describe it as continuous repair without thought of the time when the machine will inevitably become unfit for service.

* * *

Opposed to this is the foreign practice which, finding its highest expression in the maintenance of motor buses in London, broadly consists in operating vehicles with the minimum of daily attention until they are absolutely unable to keep the road, when they are removed from service and rebuilt. This rebuilding occurs four times a year, the machines emerging from the workshop in as sound and serviceable condition as the day they were first put in commission.

It will at once be observed that the American system of maintenance is palliative, while the foreign method is completely remedial in character.

* * *

The advantages of the foreign system being so obvious it is aggravating to reflect that they have not long since appealed to the imagination and sense of our economists. When one stops to seriously consider the matter, it is really absurd to keep on patching and repairing a machine which, despite these attentions, never operates at its maximum efficiency. There are, of course, certain disorders which are easily and expeditiously cured. But there are many more which, however great the skill applied to remedy them, eventually cause the vehicle to be put out of service.

To accurately anticipate the time when power wagons will no longer be fit for service is to exhibit administrative genius of the highest order. Experience, however, is required in order to know the moment when a vehicle is not giving the service of which it is capable. Abroad this period of comparative uselessness is usually found to be contemporaneous with the traversing of a given mileage, which varies with the speed, load, general care and service of the machine. But whatever the manner of determining when a vehicle shall be removed from service and overhauled or rebuilt, the current expenditures for daily inspection, adjustments and repairs must inevitably be less than under a system in which the machine is doctored until it has developed fatal weaknesses.

* * *

Let us imagine two installations of gasoline vehicles, one maintained by the American administrative method and the other by European practice. At the end of six months, if the vehicles in both installations were new at the outset, they will have shown equal wear, assuming that they have been employed in identical service and operated with an equal degree of intelligence. At that time the European establishment would proceed to dismantle its machines one by one, and in all probability at the end of two weeks each would issue from the workshop in as thorough a condition of repair as when first purchased. This overhauling would represent considerable expense, but as an offset the machine would be guaranteed freedom from serious troubles for some time thereafter. In addition there would be the guarantee of a high service-efficiency. If a balance was struck between the two installations at this time the cost of maintaining the American machines would show to decided advantage.

But if we inspect both installations six months later we will find a different state of affairs. The European machines may possibly have been fitted with new clash gear transmission and other working parts which have shown very considerable wear through incompetent handling. They will have been thoroughly overhauled for the second time. But it will be noted that their service efficiency is still very high. If we enter the American establishment at this period we shall in all probability find that, pursuing the policy of continuous repair without any attempt to restore the machines to virginal efficiency, the repair cost curve has been steadily mounting and threatens to rise to the point where the curve of the foreign machines stands. We shall also find that the service-efficiency is extremely low. If we have any doubt that the curves are near each other it will be removed upon an inspection of the books of both establishments six months later, when it becomes imperatively necessary to renew many vital parts of the American machines in order to prevent a total breakdown in the service.

* * *

It is always easy for a power wagon owner to find comfort in the sophistry that the continuous repair method is effective and economical so long as a machine keeps moving. But he would presume too much upon physical laws who assumed that because a power wagon can be kept in motion the collapse of its axles, gears, power plant,

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frame and other parts is not imminent. The vibration set up by travel plays curious pranks from time to time with motor road vehicles. The strains due to high speed, overloads, and uneven road surfaces torture a mechanism which is none too well equipped to resist them. External examination, though undeniably useful, is not sufficient if a high degree of service-efficiency is to be obtained from power wagons. Hence the necessity for periodic overhauling or rebuilding.

The European practice of maintaining motor wagons is equivalent to insurance that they shall at all times be fit for duty. American practice is equivalent to wagering that what is not known does not and cannot exist. Even if there was no mechanical or economic advantage in the European method, it would still strike a prudent man that it is better to err on the side of caution than to rely upon appearances which, as all know, are too often deceptive.

* * *

At first blush it might appear that the system of periodic rebuilding, practiced in order to keep maintenance cost low and service-efficiency high, was possible only for such establishments as employ large numbers of power wagons. Such, however, is not the fact, although it is not to be doubted that by the application of such a system large establishments can obtain benefits which it is impossible to extend to small concerns. The small concern, however, must be expected to pay some penalty for the disparity in commercial importance between it and establishments of greater magnitude. The rebuilding of machines can be undertaken without difficulty in the shops of people who live out of such work. It is true that rebuilding under such circumstances will be more costly than if it were conducted in the establishment owning the wagons. This extra cost, however, is not to be avoided if the earning power of the machines is to be kept at par.

While, as a rule, power wagon owners would not be justified in relying upon the experience obtained through the operation of motor buses—the service of these vehicles being so highly specialized—it is yet of importance to remember that in such a matter as service-efficiency, and the methods for obtaining it, foreign motor bus operators have hit upon nothing new. Indeed, if one will but take the pains to analyze prevailing conditions in commercial motor vehicle service of all kinds, he will find that the administrative practices which are most admired have not originated as a result of the employment of the automobile, but can be traced back to street car and locomotive service.

For example, it is locomotive practice to set apart "shed days" for engines which have traveled a certain number of miles, overhauling taking place without regard to the known or unknown conditions of the mechanism. This mileage varies. Some roads overhaul when their engines have traveled five thousand miles and others when they have traversed ten thousand miles. Some motor bus companies in London faithfully imitate this practice, and some of the large power wagon operators in this country —very few of them however—follow suit. Similar practices prevail in the operation of street cars, urban and interurban. It is scarcely necessary to say that during the period of locomotive or street car activity there is inspection every night in the round house and barn, in addition to repairs and adjustments which can be conveniently made.

* * *

In the last issue of this paper it was stated that service -efficiency as high as 95 per cent of the total of motor wagons employed was being obtained by some concerns. It is not difficult to believe this statement if one is assured that periodic rebuilding is a cardinal feature of the administration methods in question—which assurance we herewith give.

GASOLINE MOTOR CABS IN NEW YORK

AN attempt is being made to form a company to operate gasoline motor cabs of French manufacture in New York City. The chassis for these vehicles must be purchased from an agency which controls the sale of the French factory's product in this country.

The unreadiness of our manufacturers to produce motor cabs of this type is assigned as excuse for negotiating with foreign producers.

The chief of police in Indianapolis expects to be granted an appropriation of $4,800 to be expended in buying a motor patrol wagon and maintaining it for one year. Of this sum $800 is to be set aside for driver's wages and maintenance.

The import tax on motor buses in South Africa is now fixed at 15 per cent ad valorem. Motor wagons are only subject to a duty of 3 per cent ad valorem.

TOP HEAVINESS NOT DANGEROUS

EXPERTS have publicly stated that there is practically no likelihood of a double decked motor bus overturning. One eminent authority goes the length of saying that if the machine side-slipped, and suddenly came in contact with the street curb and the wheels on one side were to rise nearly a foot from the ground, with all the people on the top and nobody inside, the bus would still right itself.

The import duty on all kinds of automobiles in Japan has been increased. Steam, gasoline and electric machines were formerly taxed at 10 per cent ad valorem. Now the duty on all machines is 15 per cent ad valorem.

Charles Jenkins, hotel proprietor at Oogupan and Baguio, Manila, P. I. holds the government contract for transportation between these points and expects soon to have automobiles transporting baggage over the route.

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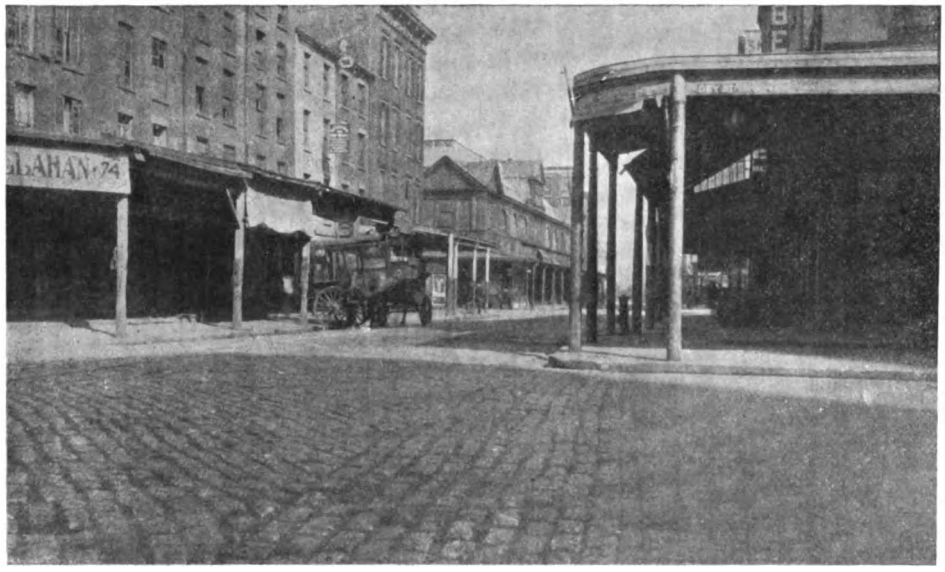


The View Shows Granite and Creosoted Wood Pavement at the Corner of Dey and Washington Streets in New York City. The Contrast is Sharp and is Strongly Confirmatory of the Value of the Wood Block.

Need of Good Pavements

Cost of Power Wagon Maintenance is Very Largely Governed by Street Surface Conditions

THE heroic efforts being made to provide the country with good roads leads many a reflecting student of national economy to wonder if commerce, industry and the welfare of the majority would not be better served if a share of the enthusiasm expended in this direction was diverted for the purpose of providing cities, towns and villages with sanitary and well paved streets.

The most ardent supporters of the good roads movement dwell, not in rural districts, but in cities. They bemoan the sad fate of the farmer who must plow his way to town, but gaze with indifference upon the abominable condition of our city thoroughfares though they menace the life and health of man and beast. If philanthropy underlies the enthusiasm of city inhabitants for good country roads it will do no harm to remember that charity begins at home.

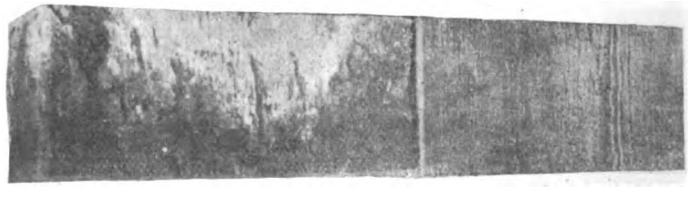
* * *

The need for good streets is even greater than the need for good roads, the stake at issue—health and industry—being greater in the city than in the country. One does not have to be identified with power wagon transportation in order to heartily support this declaration. It is endorsed by millions who use horses for business or pleasure and are forever protesting against the inadequacy of city road and street surfaces. Indeed, if the truth must be told, the power wagon has a very decided advantage over draft animals with streets as they are. To improve city pavements, therefore, would be more to the benefit of the horse than the machine. Power wagon users, however, would be quite willing to sacrifice this advantage for the assurance, which good pavements would give, that their vehicles would better resist wear, be less costly to maintain, and yield a greater service-efficiency.

The ultimate desire of every power wagon user is to operate his vehicles as cheaply as possible. So long as city streets remain in their present condition, however, maintenance expense must be high. Of course all recognize that existing pavements were laid down for horses, and not for power wagons. It is some comfort, however, to users of power wagons to know that the team owner also protests vigorously against the unsatisfactory condition of city streets. Asphalt is not at all to his liking, though if it is kept clean, power wagon operators do not object to it. Wet or icy asphalt prevents horses from keeping their footing. Granite pavement is little better for the horse, as its firm and unyielding surface soon destroys his usefulness. Nor have power wagon economists any great love for granite pavement, its irregularities setting up heavy vibrations. Team owners think well of wood pavements, particularly if it is of the durable and non-slipping kind, and in all probability power wagon owners would agree that it was as economical from an operating point of view as any to be had.

* * *

The advantages which good street surfaces would give to all forms of city traffic naturally fixes attention upon modern paving methods. The ideal paving material would provide a sanitary, smooth, silent, waterproof, non-slipping, moderately resilient, dustless and durable surface, one which would be equally suitable for horse traffic and power wagons. A paving material embodying many of these virtues is already extensively found in New York,



Worn and New Creosoted Wood Paving Block. The Picture Gives an Idea of the Compression. Worn Block Had Been Laid For Three Years.

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Boston and other large cities. Its praises are being widely extolled.

This pavement consists of sound heart pine blocks of first growth, standard 8 inches long, 3 inches wide and 3 1-2 inches deep. The blocks are first treated in creosote oil until the specific gravity is slightly greater than that of water. Then under a pressure of 200 lbs. per square inch the blocks are made to absorb 20 lbs. per cubic foot of a mixture of creosote and resin, thereby toughening the wood fibers, filling the cells and tissues and making a block which is at once hard, waterproof and sanitary. Milk of lime is then forced in to fix the whole mass. The result is a block whose chief characteristics, aside from those just mentioned, are resiliency, durability and silence.

* * *

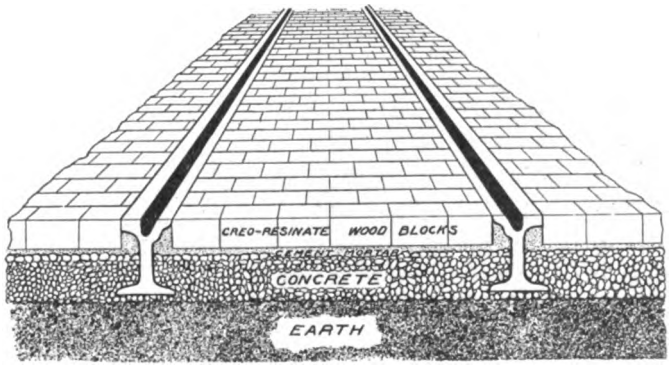
Of course this pavement has its faults. When wet it is slippery. This is the chief objection to it. But what pavement is not slippery when wet? Drivers of motor wagons assert that the new pavement is far less likely to cause a machine to skid than asphalt, brick or concrete blocks. Drivers of horse-drawn trucks are equally pleased with it. On graded streets the wood blocks are grooved every three inches in order to prevent slipping in wet weather.

It should not be inferred that superior pavements are indispensable for the economical use of the motor wagon. This type of vehicle is making rapid headway on its own merits, regardless of the handicap of poorly paved streets. But when pavement improvements extend over a considerable portion of the trucking districts of our cities, and their good effect upon the service of the machine is generally appreciated, it will then be found that the power wagon is the actual and only saviour of the pavement.

* * *

One of these days municipal authorities will wake up to this fact. They will then discover that every motor truck which goes into service, displacing two or more horse-drawn trucks, means a decrease in the maintenance of the pavement and an increase in its life. They will be convinced that if all traffic was accomplished by power wagons the life of the pavement would be almost without limit. The ceaseless tramping day in and day out of thousands of steel shod hoofs on any pavement makes alarming inroads on street improvement appropriations.

When city officials come to appreciate all this, they will lend much encouragement to the adoption of the power vehicles. We need not speculate upon what the tax payers will say when the day arrives that street improvements cease to irritate.



The Seams Between the Blocks are Filled With Tar or Cement.

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Four year ago, when manufacturers of the creosoted-wood block came forward with the proposition to lay pavements in New York with a free maintenance guarantee to cover a period of ten years, the city authorities eagerly accepted. The street railway company had previously experimented with the block between its tracks in several sections of the city, where it readily and emphatically established its merit. In 1902 experimental pavements were laid on Warren, 20th and 98th streets. As a result of the success of the material on these streets there are now between six and seven miles of it on the down town streets of New York. Yielding to the pressure of petitions by property owners, tenants and other interested citizens, four more miles are under construction, two miles are under contract, and practically all the down-town district, with the exception of West street, are included in the petitions which are now on file and in course of preparation, and which will be granted as rapidly as the city officials can act.

RURAL MAIL WAGONS

STRAWS indicate the direction of the wind. The other day a rural mail carrier in the east was presented with an automobile by the people living along his route. They wanted speedier delivery.

Wherever rural mail carriers congregate—and there are 35,000 of them scattered through the country—they rarely miss an opportunity to declare for the free and unrestricted use of the machine. Through its use they hope to improve their material condition, which, as it is largely regulated by the allowance of $720 a year from the government, is a subject for habitual contemplation.

The greatest expense attaching to the delivery of rural mail from the carrier's point of view, is the cost of transportation. To perform the duties in a satisfactory manner requires the service of two horses, and sometimes three. To maintain two horses and a human being on $60 a month is not difficult if the man can be content with a crust. But if he is to live as well as his horses he will require a little more money. A raise in salary has been proposed, but as the postal deficit for the conduct of rural mail delivery has reached enormous proportions—this year it has amounted to almost $26,000,000—it is unlikely that relief will come from this quarter.

Many carriers expend $250 a pear on their horses, harness and wagons. At least three-fifths of that sum could be saved if the mail was delivered by a light automobile.

The rural mail carrier—and let us again repeat there are 35,000 of him—desires an automobile, not for recreation, but as an economic substitute for the expensive and slow beasts he has been accustomed to maintain. He is willing to pay from $350 to $400 for such a machine, believing that it will earn its cost within eighteen months at the outside.

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The Motor Ambulance

Evidence Showing That Motor Vehicles in Hospital Service Fully Justify Their Employment

MOTOR ambulance wagons may not pay from the dollar point of view, but considered as aids to medical science and humanity they are worth their weight in gold. Their superior speed gives them a great advantage over horse-drawn ambulance wagons. A few minutes delay in transporting an injured or sick person to the hospital may result in the loss of a life.

There are at present five motor ambulances in New York City. All are electrics. Electric ambulance wagons are employed because of their ability to get into action quickly, their comparative freedom from vibration, and the ample body room in proportion to wheel base.

The Mount Sinai Hospital has used its ambulance since March 1, 1904, keeping a record of the cost of operation and maintenance. The vehicle was donated by a patron. At the time of installation another patron established a fund the proceeds of which, amounting to $900 yearly, are to be used permanently for the maintenance of the ambulance. This amount seems to be little enough for the object, but it is really more than sufficient.

The records show that for the two years the expenditures amounted to $1,829.67. This figure includes $1,200 for wages and $629.67 for repairs which latter includes all incidental expenses, a new half battery, one renewal of battery plates, and $189 for a needed, but not necessary, equipment to the vehicle. It will be noticed that during this period the expenditures were $29.67 in excess of the income provided by the fund. It is very unlikely that another year will see this mild extravagance repeated.

Even as the account stands, there is a credit in favor of the vehicle which, according to the method of keeping the records, it does not get. The driver of the vehicle receives $50 per month. He is employed in general machine work about the hospital when not operating the ambulance. Since the calls average only eight per week, some of them less than a mile or two away, the hospital gets practically all of his time at the expense of the ambulance. Aside from this there is another credit which, in connection with the $900 income, would have provided a considerable surplus on the ambulance side of the account, but which for some unaccountable reason is not posted in favor of the vehicle. Charges are made for the services of the ambulance to calls other than those of the charity wards. There are no established charges for these calls, but the amount is generally about one-half of the charge for private ambulance service. The hospital management argues, however, that these credits are just about equalized by the board and lodging of the driver, for which the ambulance is not debited. As a matter of fact, this arrangement leaves the situation in favor of the hospital, since the charges for the ambulance service exceed the cost of the driver's accomodation while the time he gives to the hospital is all in its favor.

This motor ambulance has made an excellent record. It has proven more efficient and reliable than a horse-drawn ambulance, as well as cheaper in operation

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and maintenance, not to mention its superior sanitary condition, which is a matter of much importance to the hospital management. The hospital management lodges only one objection against it. When the snow is deep in the streets the operation of the vehicle is seriously impeded. Chains for the rear wheels were suggested; but it was urged that they cut the tires. In the coming winter, however, the wheels will be equipped with loose chains, instead of tight ones, to reduce the possibility of tire cutting.

* * *

The Presbyterian Hospital has used an electric ambulance for five years, it being one of an outfit of three. The other two are horse-drawn. Dr. Fisher, who was interviewed, though very much prejudiced in favor of draft animal service, managed in the course of conversation to demonstrate its inferiority to motor service. His logic in defense of the horse puts one in mind of Herrick's well known couplet which runs thus:

I see the right, and I admire it too
Perceive the wrong, and yet the wrong pursue.

"I want to be fair," says the doctor, "but to anyone who asks me about it I put it this way: 'If we had to buy a new ambulance we would get a horse-drawn vehicle; but if some good friend wanted to give us an electric ambulance we would gladly accept the gift.'"

"What is your experience in comparative cost of the upkeep?" he was asked.

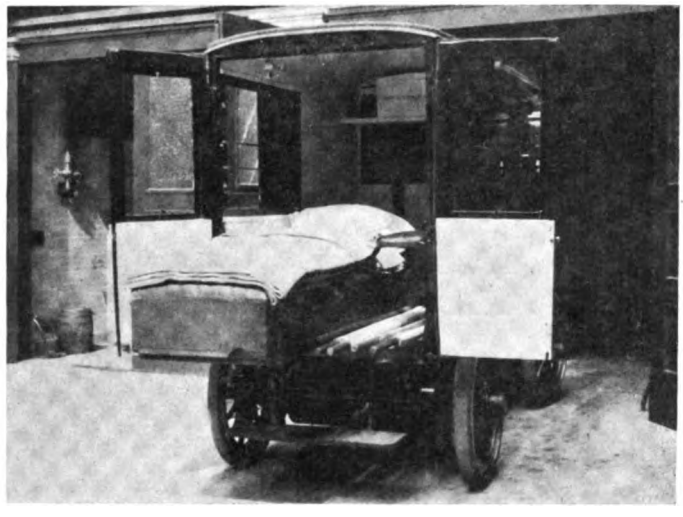
"Well," replied the doctor, "we keep no account of it. But one electric ambulance costs as much to operate as two horse-drawn ones. But it does twice as much work, and I'm not so cock sure that this year it is not going to do more work than two horse ambulances and cost less to run. You see if (here is the 'if') we hadn't had considerable trouble with our horses this last summer it would be different. We lost one horse, had one go bad with us, and now another is almost at the end of his service."

When the representative of "The Power Wagon" was shown to the stable to inspect the ambulances he made inquiry for the driver of the electric machine and was told that that worthy "was out scouting around trying to buy another horse."

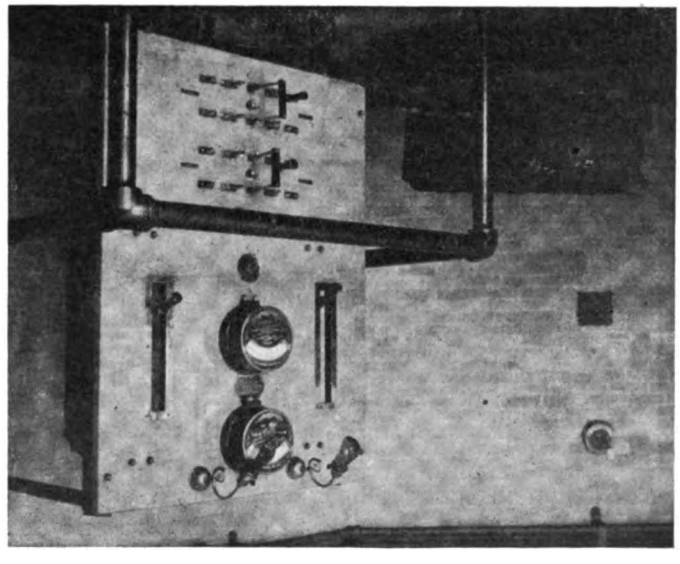
* * *

Dr. Fisher had considerable to say also about the delays to the electric ambulance in winter snows. This objection as well as that encountered at the Mt. Sinai hospital, was effectually disposed of by a talk with the chief engineer of the Lying-In-Hospital. This motor ambulance employed by this last named institution has been in constant, uninterrupted service since April 1, 1900. Barring battery trouble at the outset, which was only natural at that early stage in the development of electric vehicles, the machine has proven its ability unconditionally, even to faithful performance of duty in snow. It was stated that with chains on the wheels the machine was absolutely dependable even in deep snow. To clear a passage for the vehicle in heavy drifts a shovel is carried, which is a common practice with all ambulances.

Electric Wagon Used by the Lying-in-Hospital in New York. This Vehicle is Very Commodious, Having a Double Side Drop. It Was Put in Service on April 1, 1900.



View Showing the Patient's Extension Bed in the Mount Sinai Hospital's Electric Ambulance—Bed Partially Pulled Out.



Neat Charging Equipment in the Mount Sinai Hospit al's Garage—Extra One-Half Battery to Left of Picture.

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Battery Room of The New York Transportation Co. At the Far End of the Room is an Auxiliary Charging Board of Fifty Battery Capacity. Grappling Hooks of Traveling Crane are Seen in Picture.

Battery Charging on Huge Scale

Description of New York Transportation Company's Plant for the Operation of Public Service Cabs

THE largest automobile station in the world is at the corner of 49th street and 8th avenue in New York City. In less than ten years it has grown from an installation of twenty-five electric vehicles until now it contains more than 600 machines of various types. Most of these, however, are coupes. This equipment—operated by the New York Transportation Company—is being added to constantly. And, remarkable as it may seem, the limit of usefulness of the first vehicles installed has by no means been reached.

Necessarily the work of caring for so large a number of vehicles in service has had to be systematized. This has been done along lines to effect the greatest possible saving of time and labor. In other words, to keep the efficiency of the service anywhere near its maximum, the charging, changing, and all handling of batteries, is done by machinery.

When a car comes up for a change of battery a machine pulls out the exhausted battery and shoves in a fresh one. It lowers the dead battery on to a tramcar which carries it to the battery room, where a huge machine picks it up and places it upon a charging rack. As it is arranged, the whole operation of changing batteries takes less than forty seconds.

The battery-room occupies a position in the center of the building and extends almost the entire length. The room is 375 feet long and 60 feet wide. It is cement floored and rock walled. Its capacity is the enormous total of eight hundred and fifty 44-cell batteries. Of these six hundred can be charged at the same time, but to do it takes a complicated system of electrical apparatus which must be visited by the reader to be appreciated.

There are five separate rooms in the establishment: the rotary room, the switchboard room, the battery room, the pump room and the loading room, the last being a part of the garage.

The Edison company's high tension wires are tapped for 6,600 volts. This enters the far end of the rotary room and passes through a three-phase switchboard which controls the current to two banks of three-phase transformers. This high tension switchboard and the transformers are located in a high gallery. The utmost caution must be exercised in handling the switch handles on account of the intensity of the current. A big red sign lables it "dangerous." Each bank of transformers is controlled through a low tension alternating switchboard between the transformers and two 200 kilowatt rotaries whose capacity is 110 volts and 1,800 amperes. The ratio of current transformation is regulated between the transformers and switchboard by four alternating pressure

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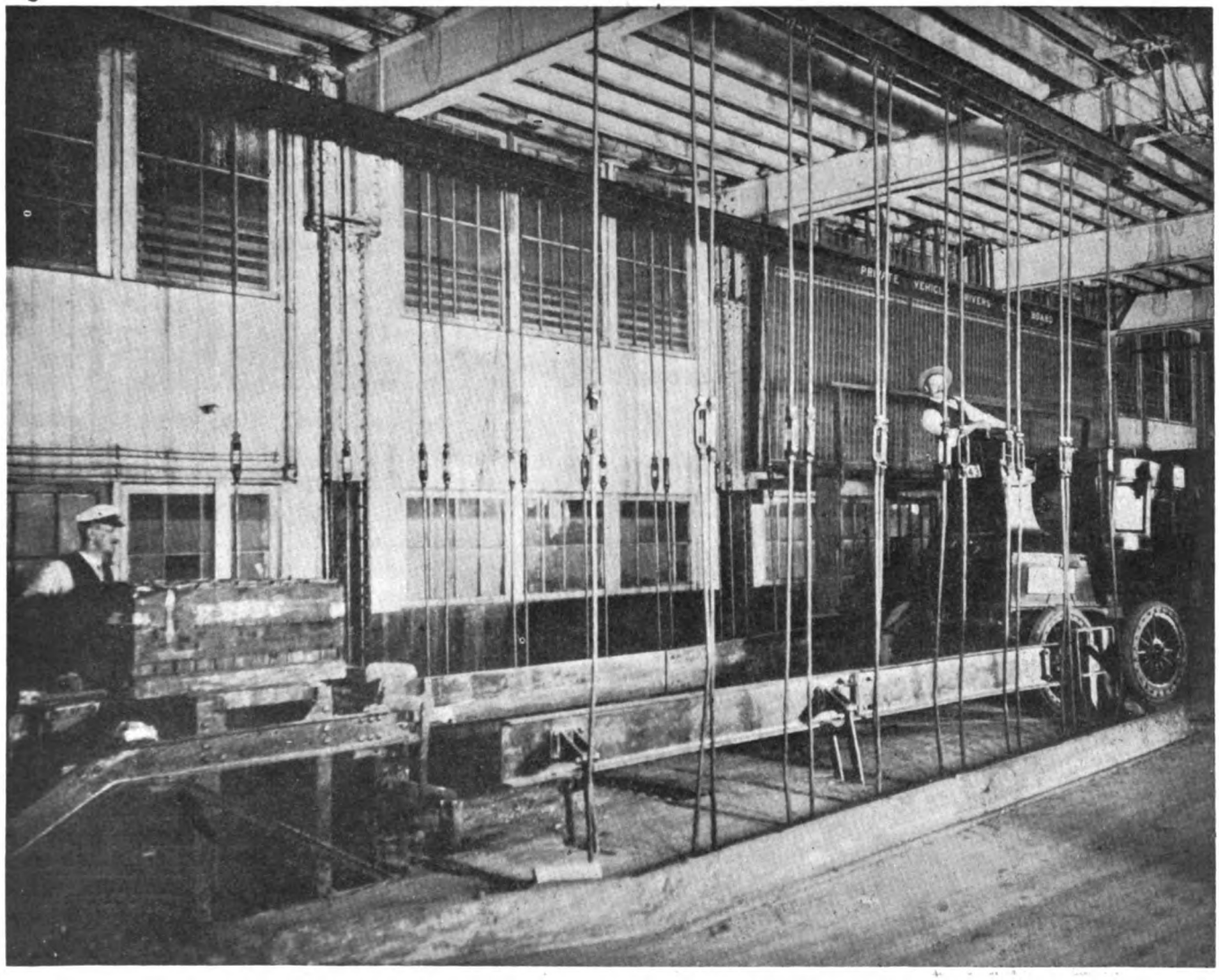
regulators. Through this series of transformations the current is stepped down and changed from 6,600 volts alternating current to 110 volts direct current.

The rotaries are located on the ground, while their control board is in another gallery together with a three tension current control switchboard. From here the current goes to the battery switchboard room on the floor above. By means of a series of storage cells interposed between the rotaries and the battery switchboard, the current is "crushed" or "boosted," decreased or increased, as required, by passing it through the charged or uncharged cell. Thus, when a full strength current of 110 volts is passed through an uncharged battery it is "crushed" to 100 volts, and when a low strength current of 100 volts is passed through a charged battery it is "boosted" to 110 volts. This enables any strength current from 100 to 110 volts to be secured on the switchboard. Sinec these various strength currents are carried on six buses at the back of the switchboard, and are wired singly to six sockets on the board, the current is closed by plugging into the socket of whatever strength desired. The three current wire from the rotary board is thus easily handled.

The switches whereby the vehicle batteries are thrown on and off charge make up the largest battery switchboard in the world. Here there are 550 switches



Method of Loading Batteries by Hydraulic Ram. There are Three of These Machines, and Two for Loading the Underhung Battery Type of Cab.

arranged on three boards in 55 panels of 10 each. This corresponds with the arrangement of the charging racks in the battery room down stairs. The racks and switches are numbered alike, the switch number corresponding to the number of the rack to which it is wired. Just above each switch are the six sockets and contact plug previously mentioned. At the top of each set of ten switches is an ammeter wired to each of the switches under it. The switches are of the twin-contact type and swing over to the right and to the left, making contact on the right with the ammeter and on the left with the charging side. One attendant has charge of the entire board. He has speaking tube communication with the battery room.

Let us suppose that down in the battery room a battery has been put upon the fourth rack in the 52nd row to be recharged. A battery room attendant shouts up the tube to the switchboard attendant: "Cut in number four on fifty-two." The switchboard man steps to the switchboard, hunts up the fourth switch on the 52nd row, plugs in whichever socket is giving 100 volts at the time,

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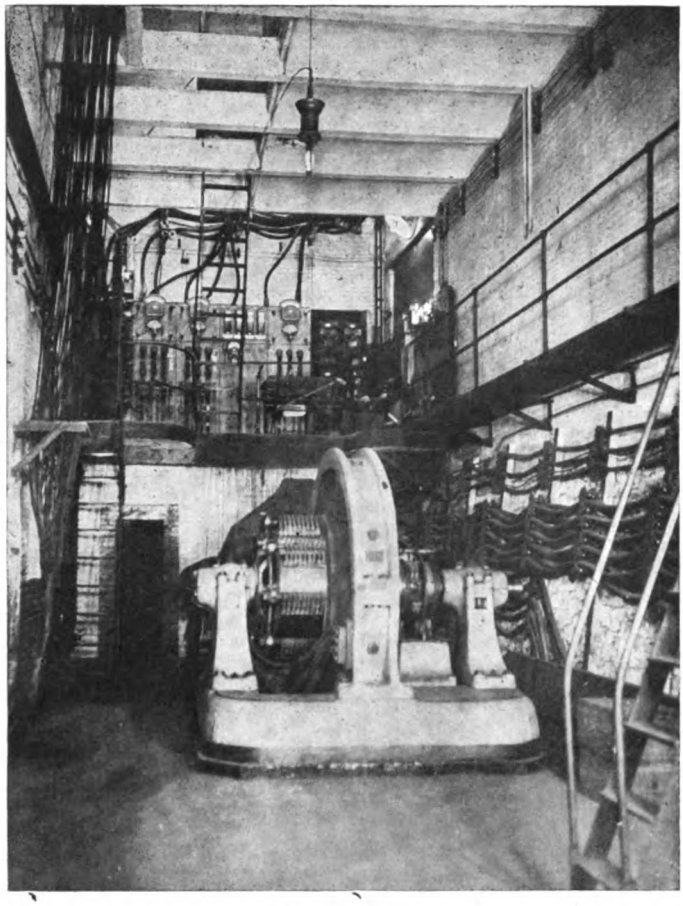
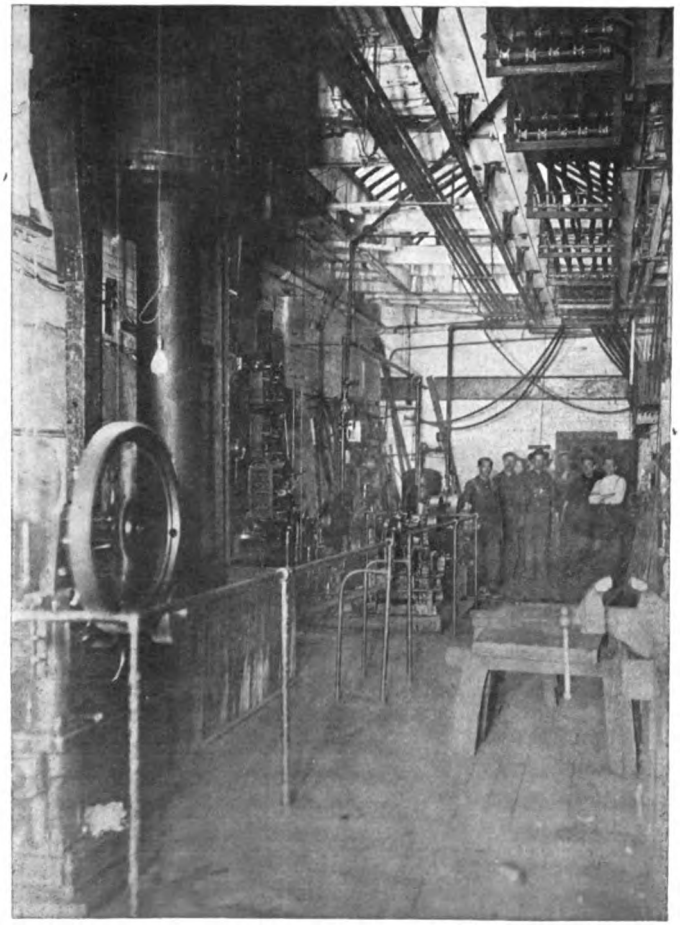


View in Rotary Room Showing One of Four Transformers; also Controller Board



Hydraulic Apparatus for Operation of Loading Rams. The Pressure Drum is Lifted by the Machine on the Left, Which is Operated Automatically.

throws the switch over to the right, reads the ammeter and, entering the reading on a slip, throws the switch to the left, thus putting it on charge at 100 volts. Every fifteen minutes he cuts in the ammeter and records the reading on the slip. In two hours he moves the socket plug to 105 volts. The final charging a litle later on is done at 110 volts. When the battery is fully charged the attendant calls down to a battery room attendant: "Number four on fifty-two is off."

The battery room itself is a weird place. Its immense proportions and unusual general appearance are, in part, responsible for this. Inasmuch as a storage battery, when being charged, gives sprays of sulphuric acid, hundreds of batteries being charged in a single room generate an atmosphere that fairly reeks with an irritating mixture which causes one unaccustomed to it to cough and sneeze. This mixture seems like a pall hanging over the room, especially so in the pale illumination of the Hewitt mercury vapor lamps which, on account of their immunity from the corrosive action of the fumes, is the only practical source of light.

Two huge electric cranes, with low hanging grappling hooks, picking up a battery here and setting one down there, are capable of handling 10 batteries at one time, or a gross load of nearly 10 tons. They travel from one end of the room to the other and roll along on rails fastened high up along each side wall. Each crane has ten sets of grapples or hooks which come down and, grabbing the battery underneath, hoist it up some six feet above the floor and carry it to a rack or a tramcar. The entire operations are controlled by one man from the bridge of the crane. The power for moving cranes and lifting batteries is electricity supplied from the rotaries. The performance of these cranes is very remarkable and constitutes the most important factor in the time and labor saving features of the establishment.

Battery racks occupy the entire floor area and accommodate 850 batteries. They are permanently fixed to the floor and are arranged in rows of ten. The wires coming from the switchboard are carried in small trenches or open conduits in the floor, and are attached to the stands by means of swinging eccentric plates hinged to the four arms of the rack. When a battery is set on, and it is desired to connect the circuit, these eccentric plates are turned in toward the battery binding posts with which they make and hold contact.

The batteries are brought in and carried out on tram cars propelled by cable electrically driven over drums. There are six of these tramways running across the room out under the garage floor. In order to make this possible the floor level of the battery room is three feet lower than that of the garage. The tramcar carries its battery along until it is in position for lifting to the loading ram, the platform for which it normally flush with the battery floor level. The ram is virtually a plunger operated by hydraulic pressure. This plunger hoists the battery to a position opposite the head of the ram ready for loading.

There are two types of these loading devices, made necessary by the two types of vehicles in service. One

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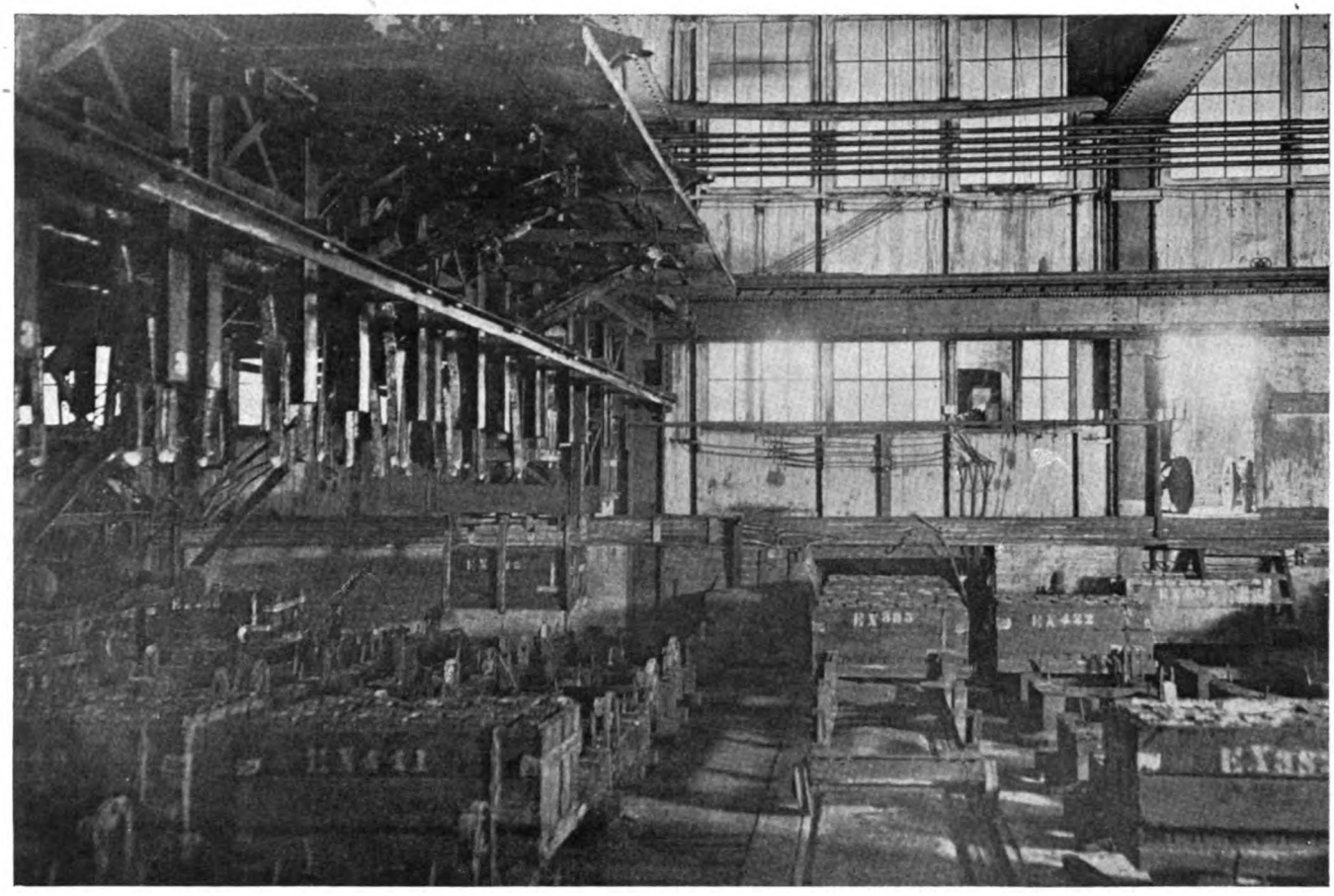
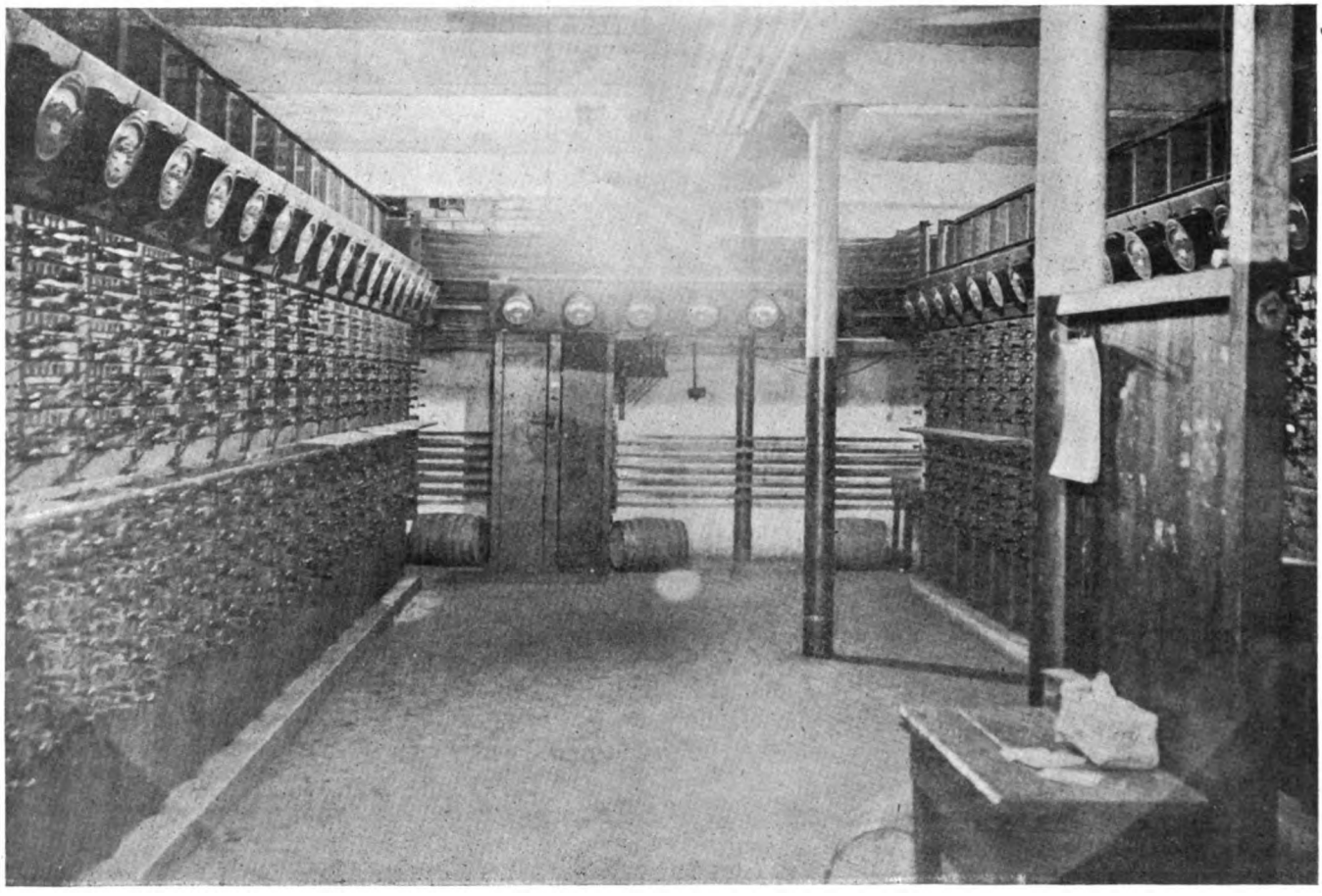


Looking Across Battery Room. Crane is Seen Lifting a Battery. Picture also Shows Fresh Battery Being Conducted on Tramway to Position Under the Ram and Over the Lifter.



View in Switchboard Room, Showing Less Than One-Half of the Switches.

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type carries its battery in the body, loading endwise; the other carries its battery underslung, loading from underneath. In loading the latter type the lifter merely raises the battery up to the proper height, when it is locked in place. With the other type, however, the loading is an entirely different matter, although the ram-loader is not as complicated as might appear.

In one illustration will be noticed a cab backing into position for loading. The battery compartment is empty; but a wire hanging from an overhead trolley is plugged into the vehicle, by means of which the cab can be moved at will about the floor without a battery. The large vertical rods seen hanging from the ceiling suspend a sectional swinging platform. The wide steel plates are arranged even with the hubs of the vehicle and as it comes in they guide it into position and align perfectly at right angles to the loading table, while the swinging platform permits the cab to adjust itself to the alignment without straining itself or the guide plates. When the vehicle has backed into position two prongs, one of which can be seen projecting beyond the table, raise the rear end of the vehicle, while the forward end is lifted by two plungers coming up through the floor. This brings the level of the vehicle's battery compartment floor up even with the platform of the ram and keeps it there until the battery is loaded.

As soon as the vehicle is jacked up the ram shoves the battery into place, the jacks drop down, allowing the vehicle to settle upon its springs, the trolley having been disconnected, and the vehicle moves away under its own fresh power to service on the city streets.

New York Transportation Co.

BATTERY CHARGING RECORD.

Station 49th St. Date 9-25-'06

	Battery No.	Switch No.	Time	Amperes	Volts	Time Off	Amperes	Volts	Ampere Hours
49th	489	3-22	12 05	25	98	4 25	15	110	
	456	4 —	—	30		—	12		
	485	5 —	—	20		—	14		
	483	10-23	—	35		—	13		
	464	1-16	—	40		—	12		
	74	2 —	—	35		—	15		
	384	3 —	—	20		—	19		
	84	4 —	—	45		—	20		
	457	1-18	12 30	20		3 25	11		
	385	2 —	—	35		—	13		
	357	3 —	—	40		—	10		
	452	4 —	—	50		—	15		
	343	1-19	12 45	20		3 40	14		
	313	3 —	—	35		—	19		
	368	4 —	—	40		—	16		
	335	2 —	—	35		—	10		
	379	1-20	106	20		4 06	16		
	69	2 —	—	40		—	12		
	408	3 —	—	35		—	14		
	354	4 —	—	25		—	16		
	373	1-21	1 35	40		4 40	11		
	302	2 —	—	20		—	17		
	6	3 —	—	40		—	19		
	445	4 —	—	40		—	14		
	408	1-15	1 45	30		4 30	12		

Started by [illegible] Finished by [illegible]

This Card is Filed as a Condensed Record of the Charging of Individual Batteries.

NEW YORK TRANSPORTATION CO.

49th STREET STATION.

Date SEP 24 1906

Battery 473 Gravity

Vehicle 518 Loaded 7 40 A. M.

TRIP	MILES	DRIVER	CONDITION
1	7	89	Ok
2	11	107	"
3	6	93	"
4	8		weak
5			

Cyclometer reading incoming	3	4	8	1	
Cyclometer reading outgoing	3	4	4	9	
GROSS MILEAGE			3	2	

Unloaded A. M. 5 10 P. M.

This Card Goes With Battery When Loaded Into a Cab. It is Used to Keep a Check on Mileage of Batteries and tires.

Motor buses of German and French origin predominate in London. A short time ago a count showed that out of 704 machines used in the metropolis 252 were imported from Germany, 114 from France, 3 from Belgium and 10 from Switzerland, only 225 being of British manufacture. The German machines are generally considered superior to the French.

A motor bus line, carrying light freight, is being operated between Frankfort and Lawrenceburg, Ky.

There is a strong probability that motor buses will soon be running between Albuquerque and Roswell, New Mexico. The towns are 226 miles apart. The service, if it is established, will be a continuation of the Torrence-Roswell line. A little more than 12 hours will be required for the journey. The mail carrying contract will likely be given to the operating company, which proposes to improve the roadway.

There is motor bus communication between Lexington and Nicholasville, Ky.

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New York's Motor Bus

Brief Description of Machine Which Was Recently Put in Public Service

MALICE frequently inspires people who are profiting by the development of street railway passenger transportation to prophesy that the motor bus will never become an important factor in the civilization of large or small American cities. Overlooking the motive which gives rise to this firm opinon, it is worth while to inquire if street railway operators are doing all in their power to preserve the monopoly which public favor has so indulgently granted them.

Is street railway service—supplemented, as it is occasionally, by elevated and subterranean railways—really keeping pace with the growth and spread of population? Do straight lines, intended to tap zones of population, satisfy people who are compelled to live at a disstance from them? Are suburban residents as well served as they could wish? In short, is street railway service as flexible as the inhabitants of a city, town or village could desire? If not, there is room for the motor bus.

In all probability New York will be the first of American cities to ascertain what special virtues are possessed by the motor bus. The New York Transportation Company, which operates 700 public service motor cabs, is thoroughly convinced that motor bus transportation only needs a fair trial in order to demonstrate its worth. It is now for the second time conducting an experiment on Fifth avenue with a machine of modern type.

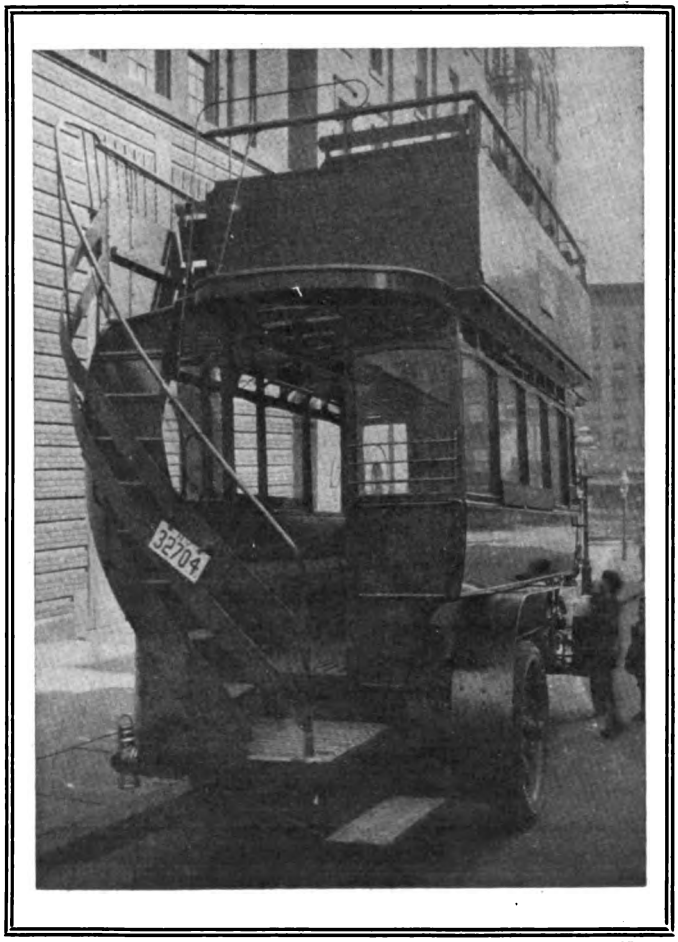
Mr. Meade, president of the company, not only concedes a wide usefulness to the motor bus in this country, but predicts a great demand for the machine within a very short time. He is particularly impressed with its availability in the development of suburban property, contending that a line of buses with operations judiciously distributed would very likely prove profitable in districts where the population would be insufficient to support a trolley system. Furthermore, once having become a necessity to the inhabitants, it would be difficult even for a trolley line to rob the motor bus of its popularity, especially as frequent service of road machines could be maintained at much less cost than trolley cars. As a feeder to existing through trolley lines and suburban railroads, and as a means of transfer between centers, the motor omnibus, in his opinion, has unlimited opportunity.

If the application of the vehicle to these fields does not commence to be evident in two or three years, or even before five years, it will not be strange, and will not reflect at all upon its utility. For some years past the manufacturers of self-propelled vehicles, working along the line of least resistance, have been exceedingly busy producing pleasure cars and trucks. The New York Transportation Company, therefore, when it first desired to test the value of the motor bus, had to be content with such meager assistance as a nearby factory could render. The result was a purely American bus—a gasoline-electric affair, which, though very pleasing to the eye and capable of carryiyng a lot of passengers and making good speed, was a failure. Why? It was far too heavy.

For its second experiment the company ordered a double-decked bus made in Europe—chassis by De Dion in France and body by the Motor Emporium in London. After a long, long wait, the machine arrived, but it could not be put into service at once as it was found necessary to rebuild the back of the body so that passengers could alight on the sidewalk rather than be obliged to get off in the middle of the street. In London buses stop at the lefthand curb, and the staircases therefore wind toward the left. The staircases of double-decked American buses should wind to the right. However, this alteration was made and the bus went into regular service on Fifth avenue on October 8.

It is not improbable that six more of these chassis will be imported and fitted with bodies here. Ocean transportation and the import duty causes the cost of these machines to mount high. But as it is apparently impossible to purchase them at home they must be procured abroad. It is said that by next summer a fleet of these vehicles will be operating in New York. Eventually, of course, they will all be American built and to specifications of the company's own nomination.

The total weight of the bus now operating in New York is 7,700 pounds. The body weighs only 2,000



Ney York Gasoline Motor Bus. The Winding Stairway Had to be Rebuilt to Allow Passengers to Alight on Sidewalk.

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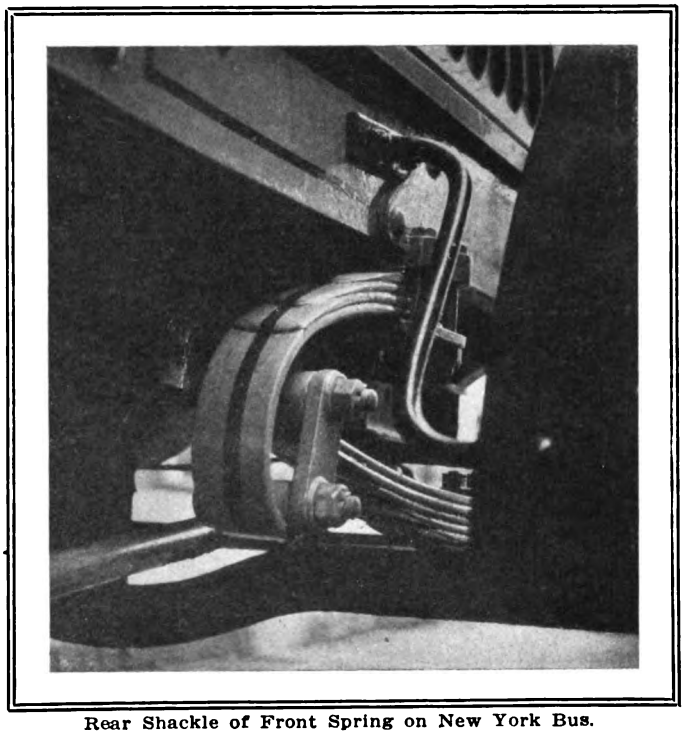
pounds, a remarkably light construction when we consider that its seating capacity is 34 passengers. The wheel base is 156 inches; tread is standard. Tires are small and of English design, 2 inch twin type on rear wheels and 3 inch single on front wheels. The American buses will have 3 inch twins on rear wheels and 4 inch single on front wheels. The motor is 115 millimeters bore, 130 millimeters stroke, and normally develops 28 hp. A four speed sliding gear transmission is suspended just



Rear Shackle of Front Spring on New York Bus.

ahead of the rear axle. The final drive is through spur gears.

The bus is a success on Fifth avenue. It was stated by the driver that there is not a grade the length of the avenue which the vehicle is unable to negotiate on fourth gear with ease.

FAILURE OF A MOTOR BUS COMPANY

THE failure of a London motor bus company, organized with a capital of $50,000, has just been announced. The promoters of the company deluded its stockholders into believing that upon such a slender capital it would be possible to purchase twenty-two vehicles at an aggregate contract price of $95,000 and after payment of a deposit upon this sum cancel the remaining obligation out of revenue. This singularly attractive plan has been put in practice on more than one occasion, and where the management and road operations were in careful hands has often been crowned with success.

Only under the most favorable circumstances is it possible to make a financial success of carrying passengers by motor vehicles with an inefficient operating staff, inferior drivers, inadequate breakdown organization and bad road and stable inspection.

It has frequently been stated by discerning critics that half of the motor bus companies now operating and being floated in London will fail because of the inattention paid to details of administration quite as much as on account of the poor judgment exercised in the selection of machines for public service.

WAGES OF MOTOR CAB DRIVERS

IN Paris the service of gasoline motor cab drivers is rewarded at the rate of $2 per day. They are, however, credited on the books of the operating companies with 27 per cent of the gross receipts accounted for by taximeters. Against this credit they are charged with 15 per cent of the total of repairs. They buy their own gasoline and oil.

Settlement for net earnings is made quarterly. Repairs include not merely the mechanical up-keep, but upholstering, painting, etc.

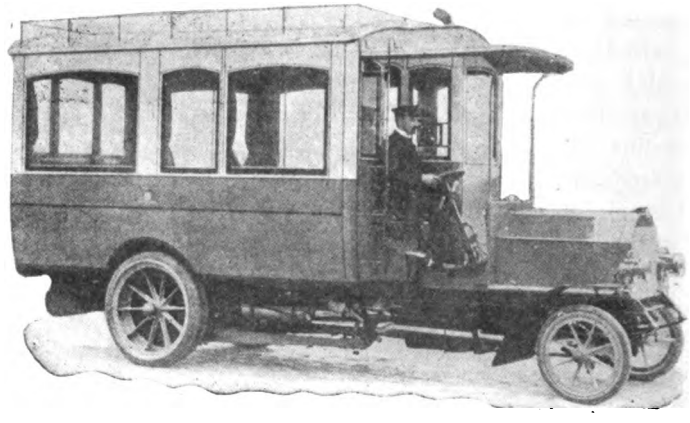
STATE ASSISTED MOTOR BUS LINES

PROFITING by the example set by Bavaria the Austrian government has resolved to connect by motor bus lines such thinly populated localities as would not justify the construction of railways. The postal service in these districts is woefully inefficient and it is with the expectation of bettering its condition, quite as much as affording improved means of passenger transportation, that state aid is to be lent to various enterprises.

Four principal considerations will govern the operation of these lines, namely:

1. Lines to be worked by the state under limited guarantee of profit by interested groups.
2. State motor lines to serve temporarily for conveying passengers and the mails.
3. Fares to be based on a uniform rate of 6-8 hellers (about two cents) per kilometer (5-8 of a mile.)
4. Post office to establish and manage the lines.

It will be observed that the Austrian authorities are not as courageous as their neighbors in Bavaria.



Bus Used by Bavarian Royal Traffic Department.

The latter assume the whole risk of their project.

The machines to be employed will carry 20 passengers, travel at 12 miles an hour and afford accommodation for passengers' luggage at the rate of 110 lbs. per head. Higher rates than 2 1-2 cents per mile shall be applied only where particularly steep gradients and unfavorable state of roads render necessary very powerful and, hence, more expensive automobiles. It is proposed to grant 33 lbs. of free baggage per passenger.

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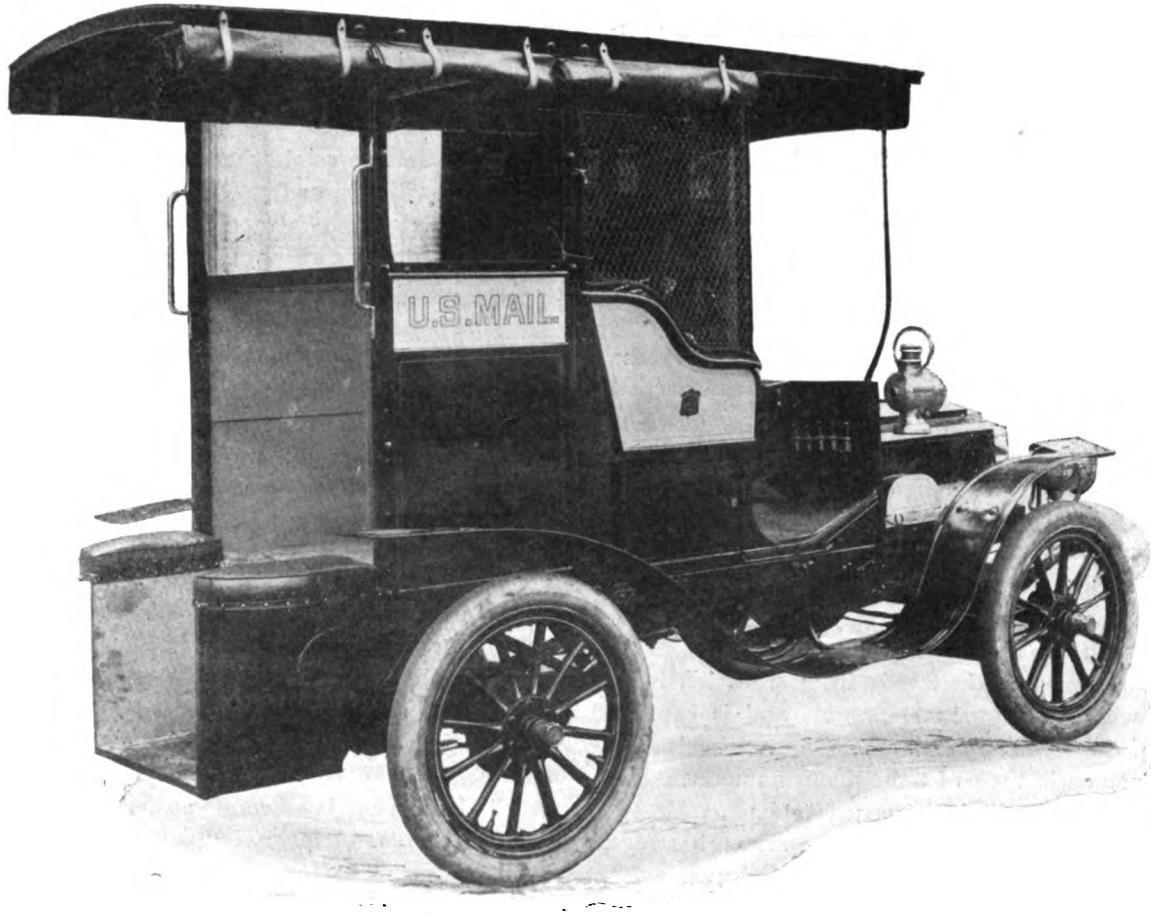

Motor Mail Collection

Postal Officials Prepare to Employ Power Wagons in all Large American Cities

MAIL collection by power wagons is a subject which for a long time has deeply interested high administrative officials of our postal department. Upon every occasion when sanction has been given for experimental service of this character the superior speed, economy and dependability of the machines have been made manifest.

Why, then, is such work generally performed by horse-drawn wagons?

Simply because the government, which contracts for the collection as well as the transport of its mails, cannot at will terminate existing four-year agreements with postal horse-drawn wagon owners. We may confidently hope, however, that as fast as these obligations expire the mails will be collected by power wagons. The first assistant postmaster-general encourages this expectation by officially pronouncing horse-drawn mail collecting vehicles in large cities to be unequal to the task assigned to them.

* * *

At the beginning of last month the power wagon was officially commissioned for postal work in Baltimore. Two motives ruled in the selection of this city as a theater for demonstration. Baltimore's hills cause much distress to draft animals. This statement discloses the first motive. The second is found in the fact that the horse-wagon mail collecting contract, having run its legal course, is not in interference with the plans of postal authorities.

Experts in power wagon operation will not fail to recognize that the hills of Baltimore are advantageous rather than disadvantageous to the automobile. Engine power, if sufficient for the pupose, makes light of gradients which quickly tire horses. If the hills are covered with ice or slime the advantage still rests with the machine, for it is well-known that such conditions are easily overcome in mechanical road transport.

It is an axiom among power wagon makers that the conditions which are best for the machines are those which betray the weakness of the horse. The practically undiminished speed of a machine in climbing hills is a heavy handicap for the animal which has to be "breathed" from time to time if the ascent is long. Traveling over level ground the superior value of the machine's power is not so dramatically exhibited, but it is obvious none the less.

The importance of haste in the performance of work in every branch of the postal service is too obvious to require elaboration. Speed in long distance mail transportation—of which this age witnesses the most remarkable demonstrations—must inevitably be accompanied by speed in local collection and carrying. The

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growth of commercial correspondence, the immense enlargement of rural mail delivery, the necessity for constantly extending local conveniences, these and other matters of like importance impel the postal authorities to keep abreast of the times in matters affecting mechanical transportation over road and rail.

The slow and toiling horse is the one inefficient agent in the postal service. He is to be banished for his slowness.

* * *

Four horse-drawn vehicles, formerly used in the collection of mail in Baltimore, have been put out of action as a result of the employment of two 18 hp. gasoline Columbia wagons of a type especially constructed for postal service. Each machine carries three pouches having a total capacity for 300 pounds of mail matter. An extra pouch is kept in reserve and put into service when one of the three sacks mentioned has been filled and set on the running board beside the driver. The collector rides on the rear step.

The machines are operated from the left-hand side. Each weighs about 1,800 pounds and is capable of a speed of 35 miles an hour. All four wheels are fitted with pneumatic tires of 3 1-2 inch diameter. The engine is of the two-cylinder opposed type.

In order that a comparison may be drawn between the efficiency of these machines and horse-drawn wagons so generally employed in mail collection work, fifteen of the latter vehicles will be retained in service.

The crew of each machine consists of a driver and a collector. Temporarily an observer is occupying a seat along side the driver. His duty is to note and make official report of the vehicle's behavior on the road and, presumably, keep track of the cost of operation. It will be understood, of course, that the conclusions which eventually will be drawn from inspection of the maintenance and operating reports prepared by this observer will not be of much value outside of postal work.

* * *

As mail colecting contracts will expire in many large cities throughout the country within the next year the keenest interest is being displayed in the performance of the Baltimore machines. Detroit's postmaster, who has had a machine collecting mail from outlying stations for the past six months, has been authorized to contract for a more extended service. At present there is motor wagon service in the transportation of mails between the main office and station F at Milwaukee Junction. Postmaster Warren would like to have the service established between the other branch offices and will forward the bids received to Washington. The existing contract for horse-drawn mail collection does not expire until June 30, 1907.

* * *

Three years ago Cleveland's postmaster tested power wagons in mail collection and became convinced of their value. Recently he was negotiating with the street car company for a special trolley car to operate between central and sub-stations and to carry mail exclusively. The street car company wanted 20 cents a mile, but the government would not bid more than 17 cents.

* * *

The next spring Milwaukee's postmaster will be given an opportunity to prove his faith in the superior worth of the power wagon. He says: "One machine would collect all the mail on the east side, once an hour. I believe six machines would do more work than the fourteen wagons now in use. They are indefatigable and all they need is careful attention. I personally should like to see a local company get the contract for furnishing the machines, so that if anything should happen to one of them, new parts could be secured at home."

* * *

In Minneapolis mail will be collected by automobiles from down-town boxes and sub-stations if some responsible concern will come forward and guarantee the efficiency of the service.

* * *

The postmaster at Kansas City was recently instructed to advertise for bids for the service of two mail collecting power wagons, the work of which is to begin at once and continue for four years. Two of the local automobile firms bid for the award. The wagons will not be purchased, however. Their service will be hired to carry mail from the thirty sub-stations, which work is now being partly performed by street cars. The power wagons must be new or as good as new. At all hours of the day they are to be subject to the orders of the postmaster. The successful bidder must give a bond of $3,000, and a check, duly certified, must ac-

Group of 2-Ton Gasoline Buses Employed to Carry Mail in England, Where City and Long Distance Delivery is Undertaken by Government Contractors.

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company each bid. Concerning the bids the postmaster said: "I am doubtful of their acceptance. They are too high. I cannot, of course, give out the names of the bidders and the amount of their bids. But I will say that thy call for too large a sum, in my opinion."

"Do you think that the quality and amount of service might make up for the increase in cost?" was asked.

"They would do more," he replied.

One of the local dealers who did not put in a bid, says: "It will not pay to put machines into the local postal service. If we could run for two miles or so between stops, then money could be made out of such a proposition. But this work would call for frequent stops, in fact many are but a block apart. This continual stopping and starting is very hard on a machine. The wear and tear is very expensive, and by the time that item is balanced against the pay we would receive there would be little left to pay for the work. So far as I am concerned, I would not have the contract.

* * *

As soon as the necessary arrangements can be made the city post office of Pittsburg will have an automobile on its carrier staff to collect mail from the boxes in the suburbs and for moving heavy mail from all parts of the city to the main office. Postmaster Davis estimates that it will not cost more than $1,200 a year to hire a motor wagon for this purpose. At any rate, this is the limit of cost upon which he will have to figure.

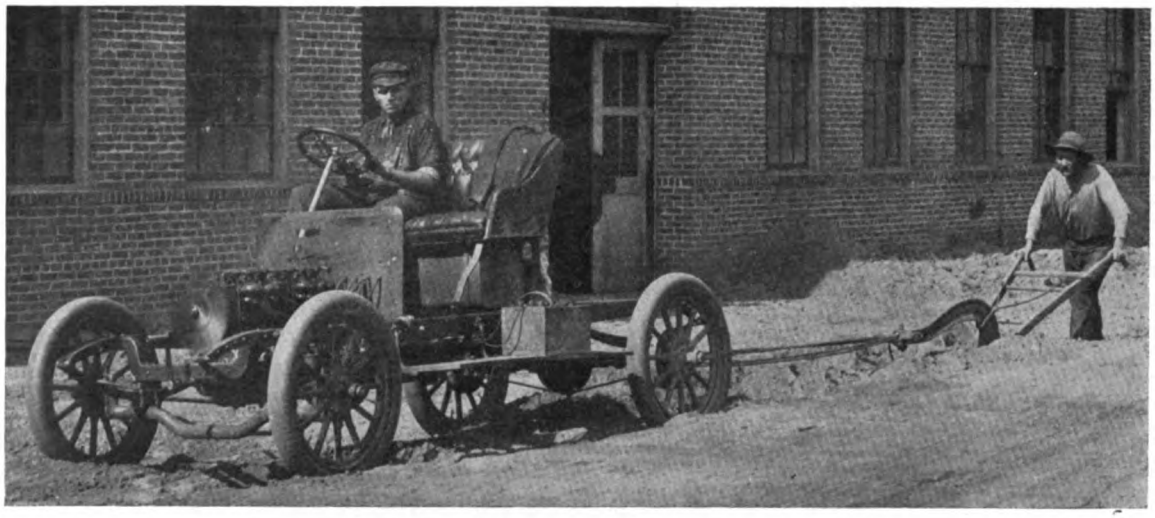
* * *

Mail collecting power wagons will also be employed in the Philidelphia post office before many months have passed. "We experimented with the power wagon two years ago," says Assistant Postmaster Knowles, "and found that with half the labor and half the time, but with an equal expenditure of money, the use of the machine for purposes of collection and delivery resulted in twice as much work being accomplished. By this I mean that one motor wagon, with half the attendants, covered twice as many districts as the horse drawn wagons."

MOTOR WAGONS FOR CIRCUS COMPANY

FOR some time past it has been gossiped that Ringling Bros., the well known circus proprietors, were considering the employment of power wagons for the transportation of their equipment through the country. The story, at first regarded as a clever piece of work on the part of the circus' press agent, is now being seriously considered since it develops that the Ringling Bros. have carefully calculated the economy to be derived from the substitution of motor wagons for draft animal service.

It is now unofficially reported that a contract has been signed for the purchase of a large number of motor trucks from a manufacturing concern located in Pontiac, Mich., involving the expenditure of about $250,000. Color of truth is lent to this report by the statement that the manufacturers who have secured the contract have stopped all other work and will maintain day and night shifts on the Ringling Bros. order until it is completed. The trucks are to be delivered at the winter quarters of the circus in ample time for use at the opening of the 1907 season in Chicago next April.



Plowing Streets by Motor

MOTOR cars have been used for so many purposes foreign to those for which their designers intended them to be employed that no great surprise is caused when we are informed that one of them was recently used to plow a street in Detroit which stood in need of paving. On one side of the Aerocar Company's plant was a hard cinder driveway which had been graded so high that during heavy rains the water ran into the building. It was decided to lower the grade and thus remedy the trouble. Someone suggested that a motor car be used. It was not thought possible that it could pull such a dead load. It was stated that the wheels would spin round before the dry hard roadway would give way to the plow. A machine that was being tested was hitched to the plow with a doubled rope. The powerful four cylinder air-cooled motor was then started, the clutch let in, the wheels began to dig, the point of the plow sank out of sight and the hard packed ground cracked apart and was turned by the share.

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Using Power Plant of Motor Wagon to Pull Telephone Cables Through Conduit.

Substantial Economy

How One Concern Saves Money by Auxiliary Use of the Motor Wagon's Power Plant

THE usefulness of the motor wagon is not limited to the duty of transporting materials. Its power plant is available at all times as a stationary unit to take the place of human and brute labor.

Conditions are often encountered where the power of the vehicle can be applied externally with great advantage—as in hoisting loads or extricating a mired machine by attaching one end of a steel hawser to an immovable roadside object while the engine winds the other end upon a drum, as is frequently done in military motor wagon transport. The New York Telephone Company's motor cable wagon furnishes an admirable illustration of the valuable aid which the motor can occasionally lend apart from its use in propelling the vehicle.

Prior to the installation of this vehicle it was necessary to pull the telephone cables through their underground conduits by means of a capstan operated by seven or eight men. The operation was slow in comparison to the speed with which it is now done, although it was not considered slow three years ago. Eighteen hundred feet of cable pulled in in eight hours was considered a fine day's work. Now, however, the foreman of the wagon is disappointed if he falls short of 5,000 feet in the same length of time, and a mile is nothing to boast of.

The wagon has a carrying capacity of five tons. It carries its own reels of cable, pulleys, stanchions, tackle and all necessary equipment, to and from the place of work, together with the men connected with it. Its power equipment consists of a battery of 44 cells and two motors. One motor is hung forward of the rear axle and propels the vehicle through a spur gear drive; the other, of 2 1-2 hp., is mounted under the driver's seat, and is geared to a drum around which it winds the pulling cable. The steel uprights, which can be seen extending downward into the manhole, carry adjustable pulleys at the top and bottom, guiding the pulley cable and holding it straight with the conduit through which it is pulling the telephone cable.

The advantages of this wagon are manifold. It does the work of two or three draft animal trucks which formerly transported the cable reels and tackle to the scene of the day's labor. Aside from pulling about three times as much cable in a day as was pulled by the old method, it pulls a much larger cable. Formerly the cables contained fifty pairs of telephone wires, and to pull any more than this was utterly impossible. Now, however, the cables contain 300 and 400 pairs of wire, so that the actual amount of work done is about ten times that possible only three years ago.

Formerly manual labor was always employed. The use of horses was out of the question on account of the fact that in circling about the capstan they would be in interference with the street traffic.

Pulling the cables by motor power permits a deeper manhole, which is a distinct advantage in that more conduits can be placed in it and thus enabling the telephone company to rest easy concerning the matter of caring for the expansion of its business. Eight feet was the former limit to the depth of a manhole, while 20 feet is now not at all uncommon.

But more than all of these advantages is the time saved in getting to and from work. The motor vehicle's gain in speed over the horse-drawn trucks enable its crew to work from fifteen minutes to an hour more each day

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than formerly, especially when the work lies at a considerable distance from the company's warehouse.

In the course of a day the vehicle uses about as much current as if it were an ordinary truck in constant operation, or, an equivalent of 30 miles per day, which is one full charge.

The superintendent of cable work is more than pleased with the efficient service of this wagon. The three years during which it has given an absolutely uninterrupted service have surely been sufficient to test its practicability.

SPEEDY FIRE DEPARTMENT VEHICLE

NINE fires out of ten can be quenched before they have made much headway if aid from the fire department can be speedily obtained. The rapidity with which fire fighting apparatus can be brought into action therefore, is a matter of the very highest importance. Hence the motor driven fire vehicle.

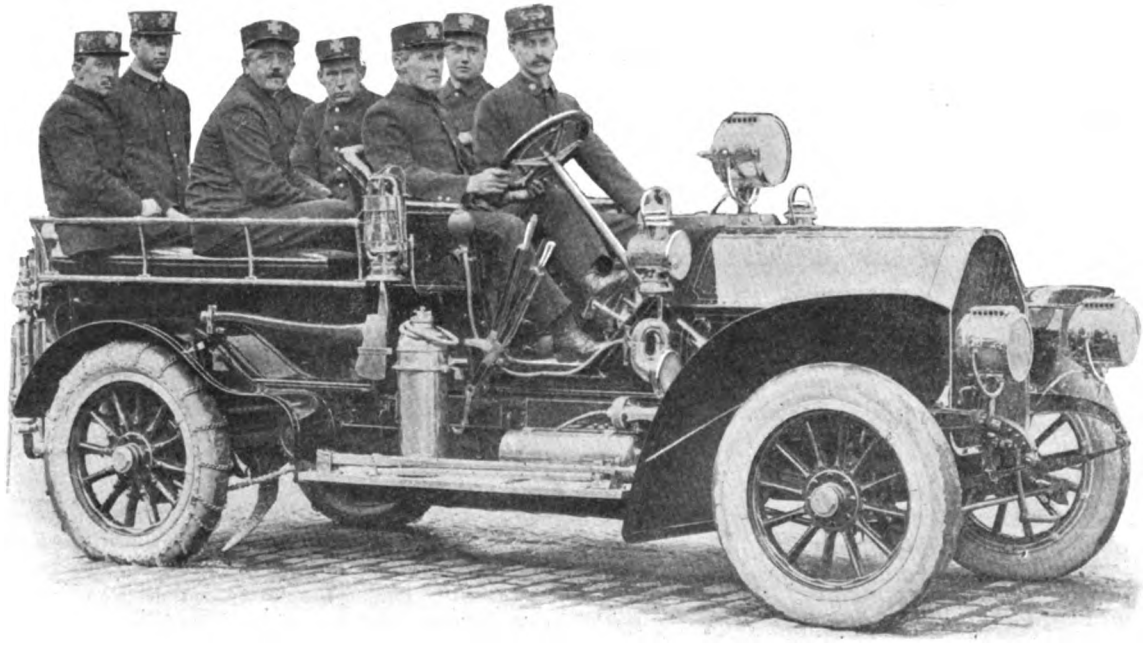
The fire department of Springfield, Mass., has just been supplied with a 40 hp. first aid vehicle made in the works of the Knox Automobile Company, capable of carrying eight men and having a maximum speed of 50 miles an hour. The fire apparatus consists of chemical extinguishers, 200 feet of hose, an equal length of rope, and implements which can be effectively used at outbreak of a conflagration. The engine is of the four cylinder variety, air cooled. Sand, contained in boxes and feeding through a nozzle in front of the driving wheels, gives good traction on slippery pavements

The vehicle was purchased as a result of protest made by the insurance companies, which complained that the fast growing city was not adequately protected against the ravages of fire. The city had the choice of putting more firemen on the pay roll or installing an up-to-date machine. The result of the choice was never in doubt. The eight men composing the crew were individually trained at the Knox factory in the use of the car, so that each may be called an expert.

The car is located at the central station and answers every alarm, and its efficiency has been proved in a marked way many times since its inauguration. On the same day the car was delivered to the department—in fact, in less than two hours thereafter—it responded to an alarm only two blocks from an engine department. The emergency crew arrived at the scene of the fire and was at work before the engine arrived. The car has been in service somewhat over a month and the fire department and city officials are so convinced of its merits that negotiations are pending for another of like design, in order that one may attend down-town alarms and the other those on what is known as "The Hill," which is some distance from the down-town stations.. The economy is best evidenced from the fact that twenty men were contemplated as an addition to the department, while it is admitted that the eight forming the auxiliary crew are far more efficient than the twenty could possibly have been, scattered among the widely separated stations.

A fifty-passenger motor stage is being operated between Flushing and Whitestone, L. I. The fare is only five cents, four cents cheaper than the railroad fare. The company intends adding several other vehicles to the service, the route to include many villages which now have no direct means of transportation.

Persons living on rural delivery route No. 1 of Paterson , N. J., have given the carrier an automobile in which to make his deliveries. The route runs through the Preakness mountains and covers twenty-seven miles. The journey is now made in three hours and three-quarters, while with a horse and wagon it took eight hours to cover the ground.



Fire Department Vehicle Used in Springfield, Mass.

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Motor Bus Trust

Cut-Throat Competition Among London Bus Companies Makes Amalgamation Desirable

FOR a year past it has been freely predicted that unless means were found to prevent the cut-throat competition which exists among London motor bus companies the ruin of all would be accomplished, and the industry of which they were the exponents and pioneers would collapse as quickly as it had been created.

Long ago it was suggested that all the bus companies, both horse and motor, should amalgamate in order to defeat any scheme on the part of the London county council to take control of the surface traffic such as is exercised by the Paris municipal council.

Threatened from within and without the majority of the companies favored amalgamation, fearing that if the day for consolidation was too long postponed the millions invested in operation and manufacture would be wholly lost. Naturally the weaker concerns showed the greatest alarm. But even the stronger ones were apprehensive. It was obvious that a consolidation of small operators would not remove the danger. The large companies could not be brought to see why they should make sacrifice to preserve the investments of the little fellows.

Thus the matter stood till recently, when it was unofficially announced that four of the leading companies had tacitly agreed to join forces and let their competitors shift for themselves. By this arrangement two of the largest operators, the London Road Car Company, owning 121 machines, and the London General Omnibus Company, operating 129 machines, are confronted with the choice of heading a new alliance or pegging it alone.

Though no authoritative confirmation of the consolidation as outlined is yet forthcoming it is well understood that the companies to be combined are: The London Motor Omnibus Company, capital stock $1,500,000; the London and District Motor Bus Company, capital stock $2,000,000; the London and Provincial Motor Omnibus Company, capital stock not declared; and the Motor Bus Company, capital stock $1,500,00. These concerns own 222 machines out of a total of 723 plying the streets of London.

The London Motor Omnibus Company, the largest factor in the consolidation, owns 159 machines, representing roughly an investment of $650,000, heads the list of London operating companies. The London District Motor Bus Company owns 42 machines, the Motor Bus Company 12 machines, and the London & Provincial Motor Omnibus Company 9 machines.

It is proposed to capitalize the alliance of these concerns at $10,000,000, which sum is so largely in excess of the value of the combined properties as to give rise to the suspicion that other companies are shortly to be taken into the combination. It is difficult to see how, from the combination of the four companies mentioned, any permanent relief can be given to the situation, particularly when such strongly financed concerns as the London General Omnibus Company, Thomas Tillings, and the London Road Car Company are not included in the combination. It is not surprising, therefore, that investors in London motor bus securities suspect the proposed amalgamation is but preliminary to one which will eventually include all of the substantial operating companies, or, as our frenzied financiers would say, the present combination is but the "first story" of an edifice upon which will subsequently be erected a second and possibly a third.

Some idea of the financial strength of the concerns not included in the combination may be gathered from an enumeration of their authorized issue of capital stock, which are as follows:

London Road Car Company	$2,500,000
London General Omnibus Company	5,000,000
Thomas Tillings	2,375,000
Associated Omnibus Company	750,000
London Power Omnibus Company	1,000,000

Any combination which did not include these giants could not be very formidable and certainly could not remedy the industrial evils of which so much complaint is heard. The London General Omnibus Company persistently refuses to be moved by the blandishments of the trust organizers. If it capitulates a huge combination will be formed. If it doesn't even the small enterprise now in process of development may be abandoned.

It is strongly suspected that the proposed combination masks a deep laid plot to fleece investors in motor bus securities. This suspicion is not allayed upon reading the following article taken from a recent issue of a paper which reflects the progress of the industrial motor road vehicle:

> It is interesting to note that the four companies concerned in this rumored amalgamation are controlled and directed by the same group of financiers; hence the benefit that may be expected to accrue will depend entirely upon the nature of the proposed fresh internal contracts. As the arrangements are only under discussion, and may be greatly modified before the intended formal combination is carried through, it is only possible for us to express the opinion that any intention to "rig the market" or seek for plunder in the course of the contemplated exploitation, will meet with a cold reception at the hands of the public. We can quite understand that the interests concerned are eager to have some scheme of amalgamation to dangle before the eyes of their shareholders. It is an open secret in well-informed circles that negotiations for a combination with the oldest and largest of London's great omnibus companies only fell to the ground, not many weeks ago, because the newer interests desired unduly to load the proposition with capital that would have been unrepresented by any substantial assets. In these circumstances, we regret our inability at present to regard the alleged scheme as having any foundation other than the narrow one of adventitious benefit to a small group of financiers. Unless, when the scheme is ripe, we are able to discern clearly the sound business merits for which one looks where combination is to be of lasting service and advantage to those who are asked to put up the money, it must stand condemned. There is no more room for manipulation of promotion profits than there is justification, today, for the reckoning of a good will value in any of the metropolitan omnibus companies' balance sheets.

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Correspondence

The editor invites correspondence on all subjects connected with the use or design of power wagons. No responsibility, however, is accepted for the views expressed by correspondents. No letters from firms engaged in any branch of the power wagon industry, which may be regarded as mere advertisements of their products, will be published. However, as many of the most practical suggestions come from those engaged in the industry, their communications upon matters of general interest will be especially welcome.

Economical Speed of Wagons

To the Editor.—Your article on the subject of useful and economical speed is very timely. It is my experience that the majority of power wagon owners and drivers completely fail to recognize the importance of keeping the speed of the machine within such limits as will insure low maintenance cost. They blame the manufacturers for the results of errors of indiscretion committed by themselves. When a machine is equipped with tires selected to carry a certain load and that load is habitually exceeded in service, it is evident that any increase in speed beyond what may be regarded as a safe rate of travel can only result in unusually severe wear upon the tires which are overtaxed in cushioning the load.

To guard against this, tire makers find themselves compelled to recommend the employment of larger sizes than would be necessary if the speed were kept low, thus adding to cost of investment and running expense, while not in the least benefiting the purchaser.

On roads where the surface is bad—and there are few that are really superior which are open to merchandise traffic—excessive speed is inevitably accompanied by rapid depreciation of the machine. The speed of a motor wagon is, as you say, a feature of its economy, but its abuse may easily convert that economy into a loss.

It is my opinion that the speeds you recommend for the various sizes of motor wagons are very liberal. I would be in favor of the following rates of travel.

Wagons with	500	pound load,	15 miles per hour.
Wagons with	1,000	pound load,	15 miles per hour
Wagons with	1,500	pound load,	12 miles per hour
Wagons with	2,000	pound load,	12 miles per hour.
Wagons with	2,500	pound load,	10 miles per hour.
Wagons with	3,000	pound load,	10 miles per hour.
Wagons with	3,500	pound load,	6 miles per hour.
Wagons with	4,000	pound load,	6 miles per hour.
Wagons with	6,000	pound load,	5 miles per hour.
Wagons with	10,000	pound load,	4 miles per hour.

In the higher loads speed is very costly and is wholly unnecessary. The average speed of a two ton horse-drawn wagon barely exceeds two miles an hour, including stops, or three miles without stops. In light delivery service to distant points speed is an economy, but municipal restrictions will always tend to keep it as low as is consistent with public safety. I have put it for a power wagon at 15 miles. That is twice as fast as the average horse will draw a light load.

Besides it is important to remember that the power wagon can make its speed count for more than the speed of a horse. It will maintain its rate of travel all day if necessary.

FESTINA LENTE.

* * *

Heavy Losses Among Horses

To the Editor:—Here is a piece of information which goes to show the heavy risk incurred by those who place reliance in horses for transportation. It is taken from a recent issue of the *Team Owners Review.*

"An outbreak of glanders among horses at Dayton, Ohio, is being vigorously handled by State Veterinarian Paul Fisher and his assistants. They find hundreds of horses affected and 500 of them will have to be killed, as the disease is incurable. It is dangerous both to man and horse. There are local infections of glanders in Northwest Canada, where the range horses are badly affected.

"Range horses in Oregon and the Northwest are more or less affected with glanders and farmers should not take western range horses on the farm without veterinary inspection to know that they are free from glanders.

"The Ohio Stock Commission has appropriated $5,000 to stamp out the spread of glanders at Dayton. The state veterinarian is instructed by the Live Stock Commission to kill all affected horses and quarantine all suspected cases. Every precaution is taken to prevent the spread of the disease to horses or to people."

You are quite right in saying that the horse is a "bad risk." But your language is too mild. My experience tends to show that he is a damned bad risk.

A CONVERT.

* * *

Who Shall Conduct Power Wagon Contests

To the Editor—Makers and users of power wagons should come to a decision as quickly as possible concerning the right of automobile clubs to control competitive events in which the industrial or mechanical fate of the power wagon is to be settled. The question is not an academic one; on the contrary, it is of the highest economic importance. The fact that automobile clubs in the past have controlled racing and competitive events for touring vehicles has no bearing upon the settlement of this question.

When a touring car leaves the establishment in which it was built its road performance ceases to have any industrial value. It is different with the commercial vehicle which, when it passes into possession of its owner, commences its profit earning career. It has been justly observed in the correspondence arising out of the dispute between the Automobile Club of Great Britain and the Motor Wagon Users' Association that the club desires the improvement of an instrument of luxury, while the association seeks to assist the community in the selection of dividend earning machines.

Thus the issue is well defined. Automobile clubs should not poach on the preserves of others. If they are not restrained we may expect to see them conducting tests to determine the usefulness or efficiency of individual railroad cars, and every other form of transportation to which automobile engineering has been applied.

J. M.

* * *

Edison's Cobalt Battery

To the Editor—I wonder if the "Wizard of Menlo Park" is responsible for the "reading matter ads" which are being given out as "interviews," or if he has a monopoly on reportorial misquotation. Perhaps, in view of the "Wizard's" former disclaimers, it is a case of my partner Mr. Jorkins.

The claims are interesting, but not complete in their class. Why not claim that the Edison cobalt battery will improve the appearance of the body, the softness of the cushions, the resilience of the tire, and the excellence of the weather. What a pity if his hopes and claims cannot be realized. In view of his signed article in the North American Review four or five years ago, the chances for their realization are slight.

FOOLED BEFORE.

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Motor Wagon Operation

Tips to New Drivers and Caretakers About Things Likely to Escape Their Attention

THE sudden muteness of a motor horn is generally due either to the presence of a morsel of grit which has become lodged under the reed or else to malformation of the reed itself. In the first case, the foreign matter can generally be dispersed by tapping on the reed tube and blowing forcibly with the rubber bulb the while, but a cure for the second complaint is a more serious matter. The reed can generally be returned to its normal and sound-producing condition by this process. Take a pin and introduce it transversely beneath the reed, pushing it as far back as possible. Then with a pair of pliers bend down and straighten the reed until it is somewhere about its original position all along the tongue. It should be replaced in the tube and tested from time to time until the reed gives out its proper sound.

Starting Without Cranking

Although it is undesirable to start a wagon by any other means than those which are recognized as orthodox there may come times when the employment of unorthodox expedients are warranted. Putting the wagon in gear and pushing it may induce the engine to do its work. If it doesn't, perhaps this method will serve, but don't try it unless compelled to do so. Jack up the rear axle and have everything ready for starting. Pull the jacked up wheel around in a forward direction. which will cause the engine to throw over. The top gear should be put into engagement, as the engine will then start with less manual effort. Directly the engine is rotated, the speed lever should be put into the neutral gear position, before the jack is removed.

Heat Losses from Fouled Radiators

Whenever possible rain water should be put into radiators, particularly cellular radiators, in which the water spaces are hardly thicker than a sheet of brown paper. Avoid water with a large percentage of lime in suspension, which is precipitated by the heat and thrown down upon the inner surfaces of the cylinder jackets. and the radiator tubes in a hard layer, which thickens every day, particularly if the radiator loses much or leaks, and so requires frequent replenishment. When the furred coat amounts to any thickness, the engine will run much hotter than before, as the deposited layer is a very bad conductor of heat, and so the evil continues to grow. Experience has shown that deposits 3-32 in. to 1-16 in. thick on the jacket walls cause a loss of heat value equal to thirteen per cent., 3-16 in. thirty-two per cent., and so on.

Crank Case Examination

Examine the crank case periodically. There is no guarantee that the moving parts inside the case are receiving the full benefit of every drop of oil that is passing. The pet cock used for draining the case may have partly opened in some mysterious manner; a retaining nut may have loosened, or one of a hundred things may have happened to permit the oil to drain away, and nothing but a removal of the hand hole covers will show this.

Chain Wear

Chains which are not given good care are often found to be badly worn, being out of pitch and having side play. By out of pitch is meant a wearing of the pins from continuous use until each link is elongated considerably beyond its original length. This increase of length means considerable when the entire number of links on a chain are taken into consideration, for it is not a hard matter to realize how a jerky and uneven motion would be given to a wagon where the original pitch had been increased from wear until the chain no longer fitted the sprockets on which it ran. The pitch of the sprocket teeth, that is, the distance from the center of one tooth to the center of the next, cannot increase with wear. On the contrary, if there is any change whatever, it would be a decrease of the pitch, but that would be too slight to be measured with ordinary instruments. But with the chain it is different; that will continually lengthen from wear. It is obvious that if its original pitch were, say 1 1-2 inches, and the wear adds only one or two-hundredths of an inch to that distance it cannot be induced to lie snugly in the spaces between teeth for half the circumference of the large sprocket. This means that when a driving strain is put on the chain there is a decided tendency for the links to overlap the teeth and climb. This climbing causes a jerk in the transmission and in itself is a hindrance to smooth running. A new chain remedies this difficulty, but it may also be necessary to renew the small drive sprocket, for that, being only about a third the diamater of the large sprocket, has, of course, worn three times as fast and its teeth may be worn down to knife edges. These troubles from wear on chain and sprockets can be avoided greatly by the plentiful use of grease and graphite, but the ordinary owner does not, as a rule, bother about chain lubrication as long as chains don't seem to give trouble when running dry.

The Cleansing of Cylinders

Wagon owners who are troubled with more than ordinary carbon deposits in cylinders and cylinder heads will be glad to know of a remedy recommended by a chemist as really efficacious and harmless. The chemist advises the washing of the cylinders with a saturated solution of hypo, precisely the same as used by photographers in development. This solution is said to dissolve and carry away the carbon deposit without oxidizing or harming the metal surfaces with which it comes into contact. Faultiness in the running of engines that have originally run extremelyy well is frequently due to carbon deposits on the piston heads and the walls of the combustion chambers..

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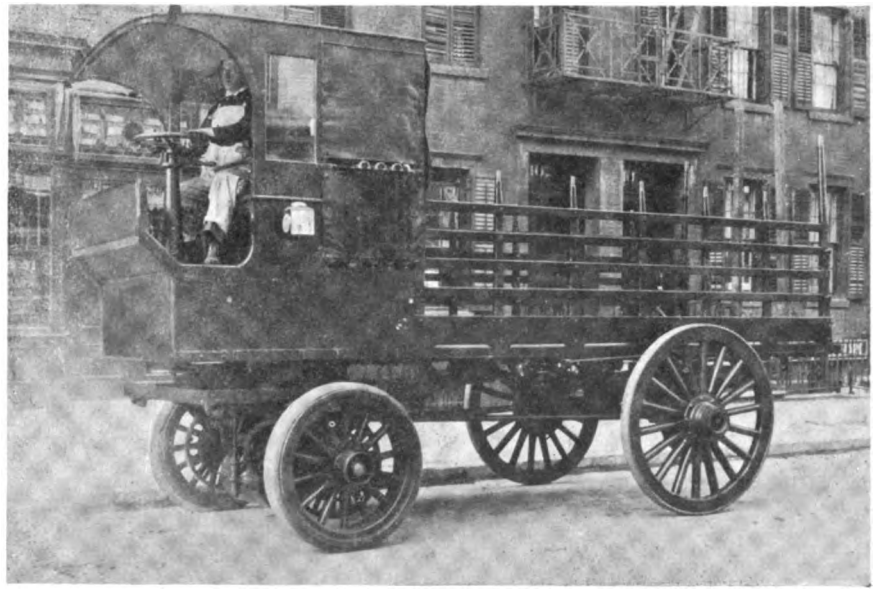


Cantono 5-Ton Gasoline-Electric Truck.

Original Construction

The New Cantono Gasoline-Electric 5-Ton Truck Has Many Radical Features of Design

ABOUT the middle of October the Cantono Electric Tractor Co., of New York City, brought out the demonstrator of its new heavy duty gasoline-electric trucks. This vehicle possesses many novel and radical features of design.

The Cantono Tractor system has been in use in this country for a little more than two years. It was invented by an officer of the Italian army. From the premise that the adaption of the tractor to all kinds of business wagons will enable them to be continuously operated, he reached the following conclusions:

1. It is better to pull than to push loads.

2. When the wagon is loaded the weight ought to be equally distributed over the four wheels.

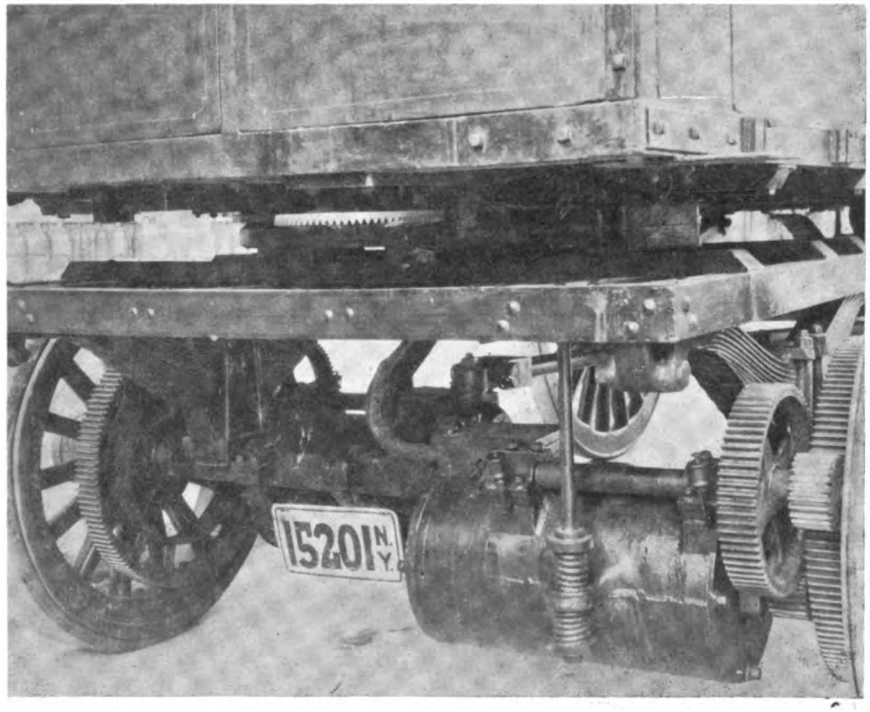
3. The driving wheels should do the steering and the breaking.

4. The actuating mechanism should be located in such a position as will make possible the equipment of different heights and types of bodies without necessitating a change in the chassis assembly. In other words, one model should meet all commercial requirements as to different body equipments.

In the Cantono system two independent acting compound electric motors are attached to the front axle, one geared to each front wheel hub. The battery is placed over the axle in a compartment mounted upon the front springs. The front end of the body is mounted on the battery compartment by means of a fifth wheel, the entire assembly of front wheels, axles, motors and battery compartment turning upon it.

The steering system is accomplished by electric apparatus controlled by the operator from the steering wheel. It is composed of two factors, both actioned by the same steering wheel, but not simultaneously. The electrical factor enters into action a moment before the mechanical one, and in varying the intensity of the current which passes to the motors varies their speed, so that the driving wheels accomplish the number of turns necessary for the curves required in turning. The total sum of revolutions of the two motors remain the same. As the number of revolutions diminished in one is augmented in the other, no augmentation of power is needed. This electrical direction, preceding the mechanical one, has the result of not asking any effort from the hand of the driver in steering, this being accomplished by the motors. The mechanical direction has the function of protecting at all times the electrical one.

The motors of the five-ton truck, now ilustrated and described for the first time, have a capacity of 12 hp., being capable of an overload of 24 hp. The battery is a



Front Axle of Cantono Truck, Showing Motors, Spur Gearing, and Mechanical Steering Which Actuates the Electric Steering Apparatus

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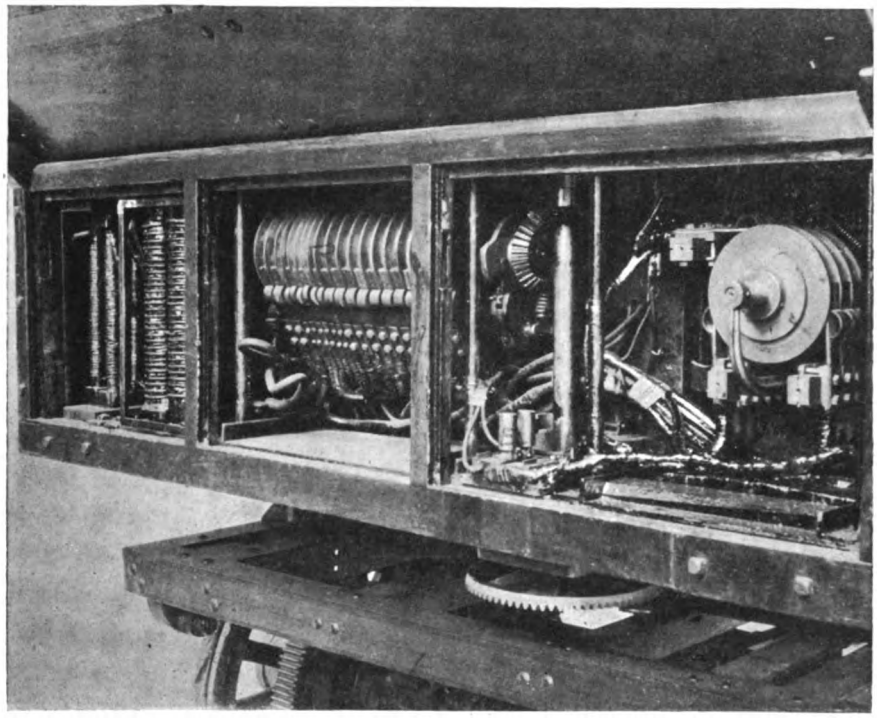
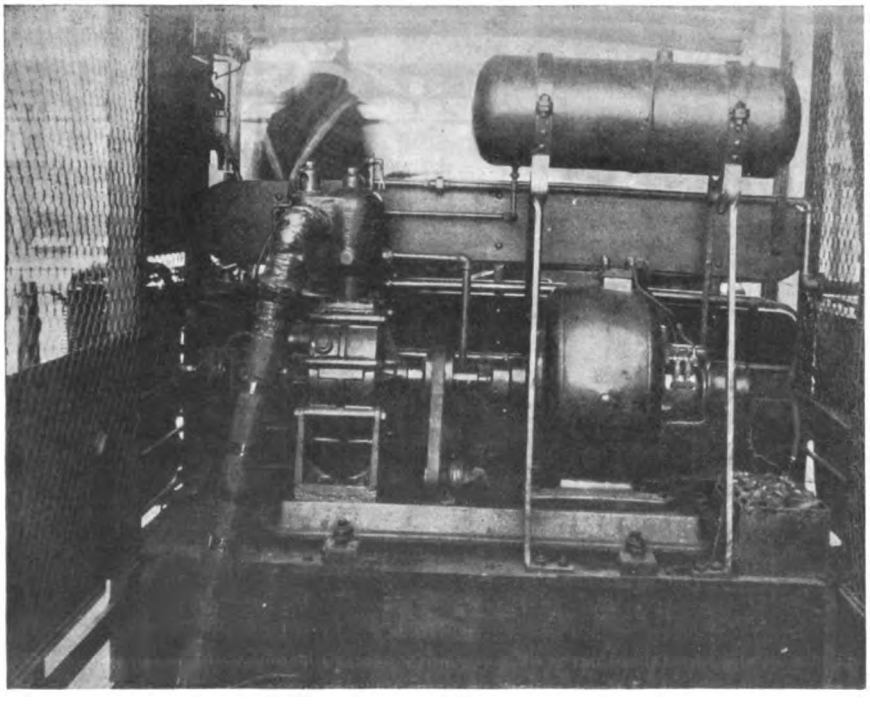
series of forty-four cells. The charging plant is at the rear of the driver's seat. It is termed the "electrogene" group, consisting of a 9 hp. gasoline engine direct connected to a dynamo. The batteries are charged from this apparatus at the rate of 40 ampere hours. Since the battery capacity is 252 amperes, the group will put in a complete charge in six hours. This charge will last for four hours on a straight discharge of continuous running at top speed. As the motors discharge 63 ampere hours, the battery will discharge at the rate of 23 ampere hours when the electrogene group is in simultaneous operation, and will make the remarkable figure of 11 ampere hours discharge at the maximum rate. As the truck would be used in ordinary service this, it is claimed, would be stretched into 15 hours.

The controller, located on the steering column, governs four forward speeds, a reverse, and an electric brake which, acting through the motors, reverses them and operates on the front wheels. This brake control is distinctly advantageous. On down grades the wagon is checked by this electric brake, and since the compound motors are reversed they are transformed into dynamos which throw current back into the battery.



Control Apparatus of Cantono Truck—Speed Control, Armature, Electrical Steering Arm, Reverse and Resistance Coils.



"Electrogene Group" of Cantono Truck—9 h p Gasoline Motor and Dynamo.

The general specifications of the Cantono truck are as follows: weight, 8,000 pounds; speed, 6 miles per hour; wheel base, 110 inches, which may be varied to suit customers; tread, 56 inches; length over all, 17 feet 8 inches; width, 69 inches; height of chassis, 122 inches; front wheels, 38 inches, fitted with 6 inch solid rubber tires; rear wheels, 52 inches diameter, fitted with 3 inch steel tires. Each rear wheel is provided with a compensating double acting metal to metal break. The stake body as shown in illustration is 5 feet 4 inches wide and 12 feet long.

The company intends to manufacture six, five and four-ton trucks.

There are four points of superiority which the manufacturers very stoutly assert make this truck particularly well suited for pulling heavy loads. First, independence of charging stations and low cost of operation; second, the ability of the truck to perform long journeys; third, the heavy reduction in tire maintenance on account of rear steel tires; and, fourth, the slight risk from skidding, due to a combination of great weight on the driving wheels and the ability to break all four wheels the same time.

A HUGE PLANT:—Samuel S. Eveland, on behalf of the Standard Roller Bearing Company, of Philadelphia, of which he is general manager, has purchased for that company the entire plant and real estate of the Pennsylvania Iron Works Company, which adjoins. By the purchase the Standard Roller Bearing Company has secured five factory buildings with a total of over 110,000 square feet of floor space, with real estate 1,600 feet by 120 feet wide, all located on the main line of the Pennsylvania railroad and connected with the property which it now occupies, making the total length of all its property over one-half mile, with an average width of 200 feet, covering 500,000 square feet of floor surface. The cash price paid for the above property was nearly $250,000. The buildings on it will immediately be equipped with machinery at an expense of over $200,000.

In addition to the above property, the Standard Roller Bearing Company is at present erecting the largest reinforced concrete building in Philadelphia or vicinity, five stories in height, 100x210 feet. This building will be devoted exclusively to the manufacture of annular ball bearings, automobile axles, etc. Over 1,200 hands are now employed, and as soon as the concrete building is in full operation, which will be within thirty days, over 1,800 will be employed. When alterations are completed on the Pennsylvania Iron Works' property, over three thousand will be employed.

During the past few months, the company has built and equipped a large crucible steel casting plant, as well as an iron and brass foundry. It has also just completed a drop forge plant, 100x150 feet, fully equipped with drop hammers. It will in future manufacture all drop forging used in its automobile axles, etc. The only materials which the company now purchases are bar steel, and iron and copper for its gray iron and brass foundries.

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New 2½-Ton Gasoline Truck

THE American Machine Mfg. Co., of Detroit, has placed on the market a motor truck of 2½ tons rated capacity. This vehicle is known as the "Commerce 4-Cylinder Truck." It was designed by Paul Arthur, who as draughtsman and designer has been connected with the automobile industry for several years.

The machine has a wheel base of 109 inches and a tread of 56 inches. Rear tires 36 inches by 5 inches. The motor is a 4-cylinder vertical, water-cooled design, of the four-cycle type. Valves are interchangeable. They are placed on one side of the motor. The transmission is of the sliding-gear selective type. The clutch is of the 3-disc variety with cork inserts. The final drive is by a countershaft through chains to rear sprockets. Two sets of brakes are provided; one pair on the countershaft, and the other on the rear hubs. The truck weighs 3,500 pounds, with type of body shown in illustration.

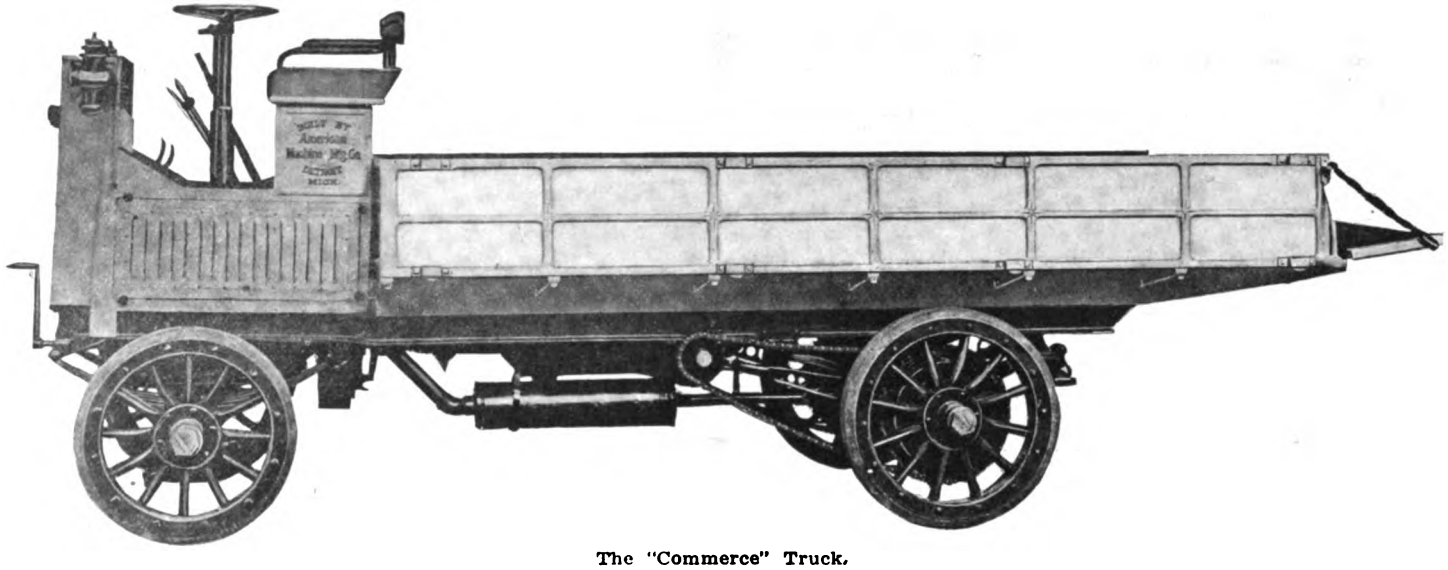
The frame is strongly reinforced. It is supported by two front side springs, two rear side springs, and one rear cross spring. This gives rear platform spring construction and semi-elliptic spring support for the front of the chassis. The motor is under the driver's box, this location making room for a larger load body. Through a panel, which may be easily removed from the right side of the driver's box, full access is gained to the right side of the motor, control quadrant, steering gear and force-feed oiler, while a panel on the left side of the driver's seat gives liberal access to the commutator, carburetter, valves, spark plugs, cam shaft, cams and timing gears. All adjustments necessary to connecting rods, etc., may be easily made with this door removed.

The load body may be removed, and another body of any suitable design may be fitted within an hour's time.

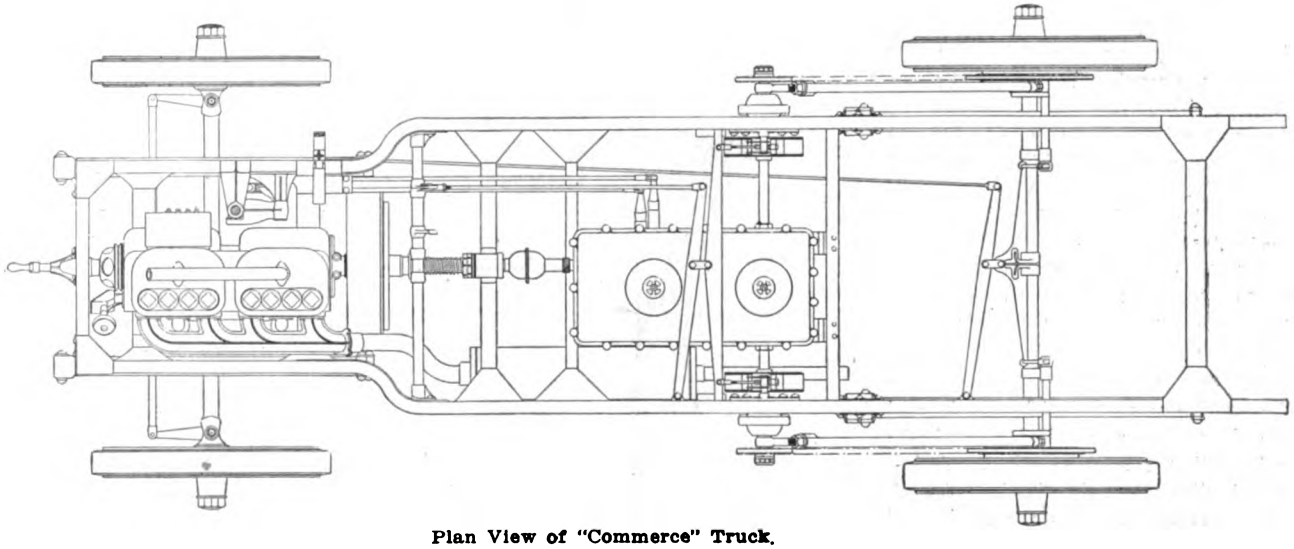
Both front and rear axles are roller-bearing. The wheels are very heavy, having 2 inch spokes, both front and rear.

The engine is hung by two 3 inch channels fastened to the main frame. There is no sub-frame. The transmission is hung on an angle cross bar in front and channel cross-bar in the rear. Both engine and transmission are so arranged as to be easily removed should occasion make it necessary.

The crank case is a very rigid one-piece casting, with a large inspection cover bolted to the left side with gravity nuts of a special design. When this cover is removed the crank pin-bearings may be adjusted, the crank-case cleaned, the cams set, and inspected, or the motor may be run with this cover off. This cover, when taken off, affords ideal accessibility to a closed crank-case of this type. The crank-shaft is made of the strongest steel on the market for automobile purposes. The connecting rod stands central on the lower end. It is not offset, thus preventing wear of one side of



The "Commerce" Truck.



Plan View of "Commerce" Truck.

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the bearing and avoiding unequal thrust on the cylinder walls. The cylinders are cast in pairs. The valve stems are adjustable. They are made of nickel steel and will not pit or corrode. Wear will take place in grinding on their seats in the cylinder, and not on the valves themselves. They will not warp. The tappets are held in continual engagements with the under-end of the valve stem by a light spring, which prevents the clicking sound these parts usually cause.

The commutator is driven by a pair of bevel gears which are enclosed in a small dust-proof case. The commutator may be removed with its housing, or separately, without taking off the cam shaft. The water intake is directly beneath the exhaust outlet on the left-hand side of the motor, thus distributing the water upon entering the cylinder where it is most needed. The water outlet is in the center of the cylinder on top, and a drain plug is provided for flushing the water jacket on each pair of cylinders.

The whole cam shaft, cams and large time gear may be taken out bodily from the side of the crank case.

The crank shaft end bearings are divided. They are adjustable, and either end bearings may be removed without disconnecting the crank pin bearings or fly wheel.

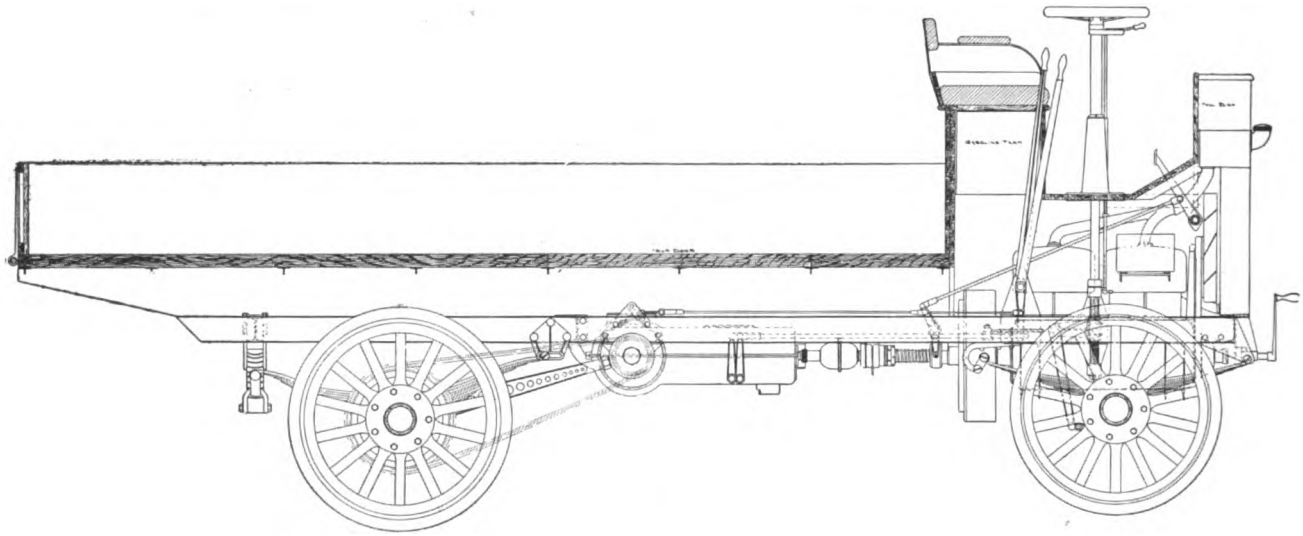
The motor is designed to develop 30 b. hp. at 800 r. p. m., and will turn up 1,500 r. p. m. easily.

The gear box encloses all the gears and the shafts, leaving only the drive shaft and counter-shaft projecting, thus making an absolutely dust and oil-proof case. The bevel gears can be adjusted from the outside of the transmission case without removing the cover.

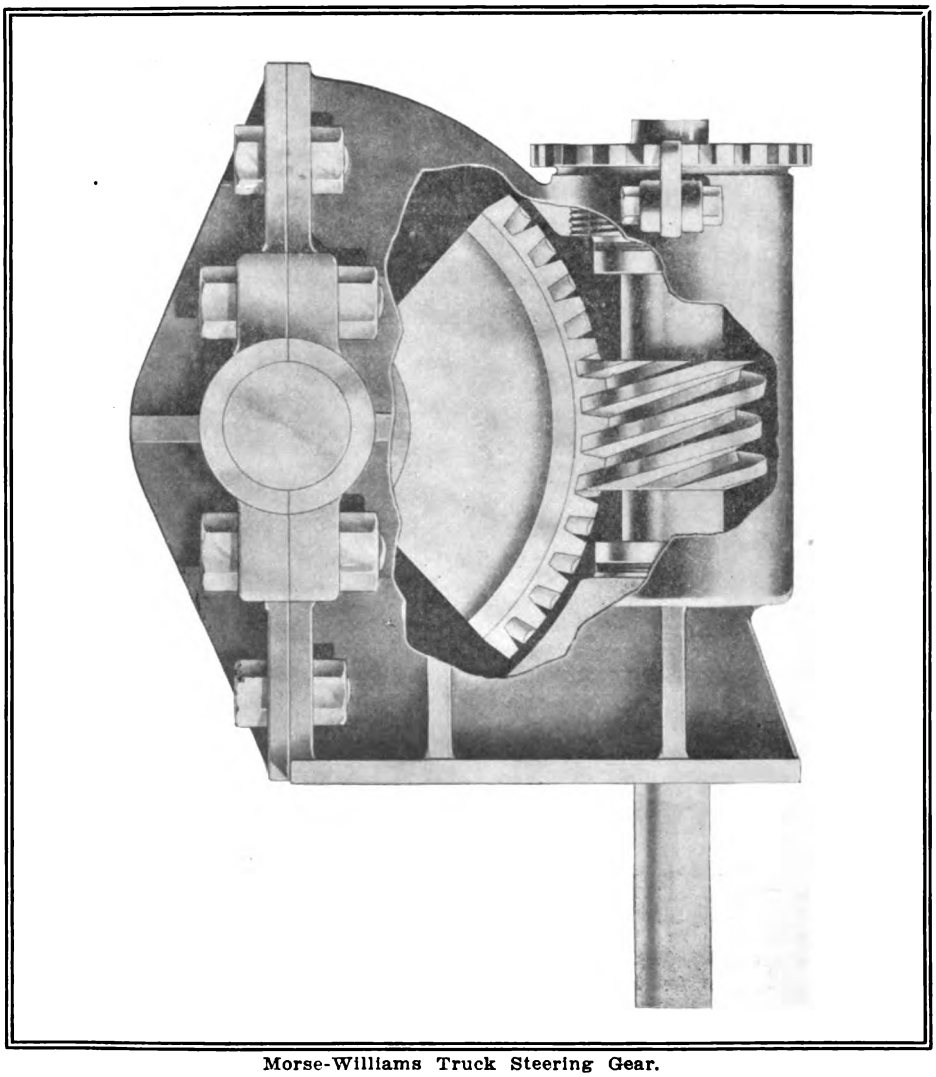
The engine is controlled by spark and throttle levers on a quadrant placed directly beneath the steering wheel. A left foot pedal disengages the clutch only. A right foot pedal disengages the clutch and applies the countershaft brakes. A hand lever to the right of the driver applies the rear hub brakes and disconnects the clutch. The inner hand lever controls the change of speed, and is provided with an interlock so designed that only one set of gears can be in mesh at one time. Much attention has been paid to the design of the countershaft and hub brakes. One of the drawings reveals a very good equalizing device, which not only applies the brakes evenly, but also prevents skidding and wear on the tires.

The steering gear is of the worm and nut construction. About three turns of the wheel are required to swing the forward wheels to their full extent.

The car is geared to one mile an hour on the reverse, 4¼ miles per hour at low speed, 6¾ miles per hour at intermediate speed, and 10 miles per hour on high speed



Type of Mail Collecting Wagon Used in Baltimore.



Morse-Williams Truck Steering Gear.

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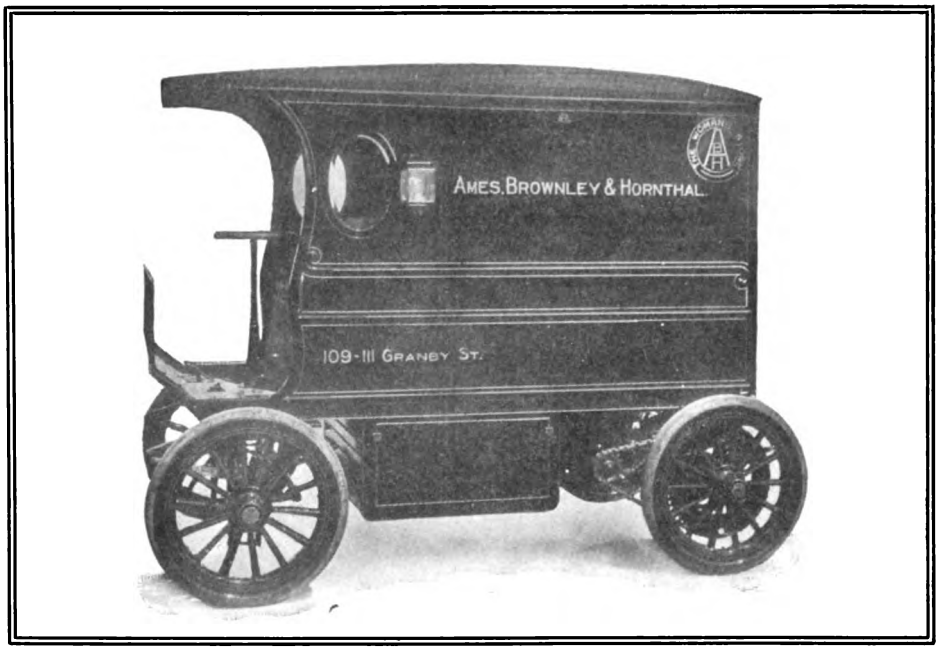
at 800 r. p. m. The motor is practically noiseless. The crank-shaft is offset ¼ the stroke. This produces a very low rod angle on the explosion and suition strokes. In actual tests this wagon has carried more than double its rated capacity on the high gear, the clutch being very smooth in action and gradually taking hold on any sort of pavement with the full load.

The American Machine Manufacturing Co. has made motors, transmissions and other automobile parts for six years. It has a very liberally equipped machine shop. Engines, transmission and steering gears for its truck will be turned out in its own plant. Deliveries will be ready by December 1.

The capacity of the plant for the season is 100 trucks.

NEW STEERING GEAR:—Morse, Williams & Co., of Philadelphia, specialties in gearing, recently produced a new type of motor truck steering gear suitable for machines with carrying capacity varying between 2,000 and 15,000 pounds. The gear casing is made in two pieces. The gears are cut from solid blanks, ground and case-hardened. The worm and shaft is forged from a forty-carbon steel ingot, worm and shaft being in one piece. The worm wheel is also of this material. The worm shaft is provided with two collars. Between them and the bearings on the casing are placed three compression washers of vulcanized fiber which eliminate shocks to the wheels in passing over rough roads. One side of the worm shaft is supported in a threaded bearing, the flange of which is slotted and provided with a locking pin, giving the proper adjustment to the washers.

LATE TYPE OF ELECTRIC VEHICLE:—The latest type of light electric vehicle produced in the factory of the General Vehicle Company, Long Island City, N. Y., has a carrying capacity of 1,000 pounds. The vehicle is operated by a single motor, back geared to countershaft and differential, fith chain drive to each rear wheel. One of these machines is illustrated. It is in the service of Ames, Brownley & Hornthal, of Norfolk, Va. It is geared to a speed of 12 miles an hour, and will travel from 35 to 40 miles on one battery charge.



General Vehicle Company's Latest Light Type.

CHANGE OF BASE:—Morgan & Wright have removed from Chicago to Detroit. The new plant was built and equipped specially for their needs. It covers an area of seven acres, the main building being of four stories, 300x60 feet. the equipment being in keeping with the splendid structure itself.

COMPANY OFFICERS ELECTED:—At the annual meeting of the Electric Vehicle Company, of Hartford, Conn., the following officers were reelected: President, M. J. Budlong; treasurer, W. G. Henderson; secretary, H. W. Kyte; directors—M. J. Budlong, F. L. Kellogg, H. H. Vreeland, H. W. Kyte, W. G. Henderson, Albert Taylor, Grant B. Schley, Jr., M. Garvin, 2d., and W. O. Knudsen.

INCREASED FACTORY FACILITIES:—The Franklin Mfg. Co., of Syracuse is getting ready for an active campaign with its 12 and 20 hp. motor wagons. Within 60 days the company will be occupying a five-story building, 60 x104 feet, of reinforced construction. A new freight house, 60x70 feet, and a saw-mill are also being built. The company will be able to produce at least 2,000 cars next year as a result of these additions to its plant.

RECENT WAVERLY MODEL:—The Pope Motor Car Company, at its factory in Indianapolis has just completed a three-ton truck for Lewis Hubbard & Co., wholesale grocers of Charleston, W. Va. The vehicle is fitted with two motors and driven by double side chains. Battery equipment consists of 42 cells, 15 plate size. Wheels are of the wood artillery type, fitted with thirty-six by five inch solid rubber tires, both front and rear. Length over all is 17 feet, and width over all 7 feet and 9 inches, the clear carrying space being 14 feet long and 5 feet wide. Wheel base is 118 inches, and the tread 73 inches.

TO USE BOTH COOLING SYSTEMS:—The Premier Motor Manufacturing Company, of Indianapolis, will in the future build trucks with interchangeable water and air cooled system. The first truck to be fitted with the interchangeable cooling system is now being built. It will be a two-ton machine, with an overload capacity of about 1,000 pounds. The vehicle will have a wheel base of 120 inches. It will be fitted with a 24 hp. engine. The wagon's axles will be solid. Springs in front will be of the semielliptic type, with platform springs in rear. Front tires will be 32 inches by 3 inches, with 32 inches by 4 inches in the rear. The maximum speed will be about 12 miles an hour. The gasoline tank will contain 10 gallons.

The Climax

A Light Convertible Delivery Wagon

PRICE $900

Light in Weight, but strongly built.

Simple to operate.

Carrying Capacity 1000 pounds.

HINDE & DAUCH, SANDUSKY OHIO

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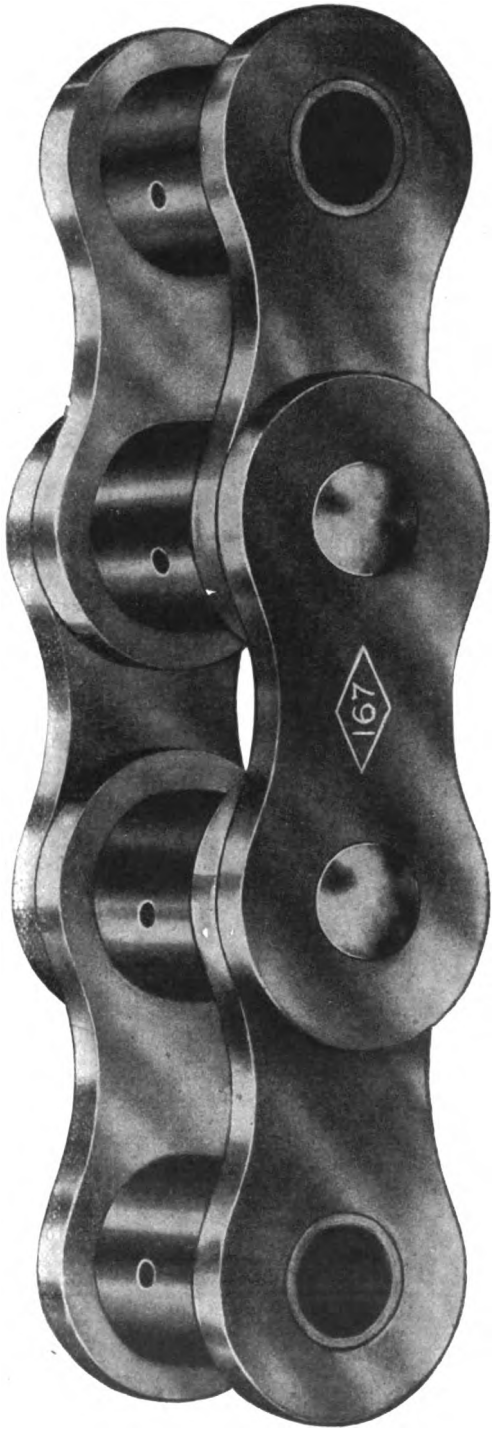
LONG LIVED CHAINS



Are the chains on your power wagon giving satisfactory wear?

If not you will doubtless be interested in knowing that "DIAMOND" chains outwear all others.

This is not merely our own opinion, but the belief of the most experienced users of power wagons who have had their machines fitted with every chain on the market.

The extreme care exercised in the manufacture of "DIAMOND" chains is not their only recommendation for service. The stock in them is of a very superior order. For example, rivets are nickel steel. Only an engineer would appreciate the refinements of mechanical practice to which we resort in order to make "DIAMOND" chains superior to any others.

The strength of "DIAMOND" chains is due to the superior material used in their construction, their design and the precision of their manufacture. We never use defective material. In fact all material is very carefully inspected and tested before it passes into our work shops, and if the slightest imperfection is noticed the piece is rejected.

Outwearing other chains stronger than others—more economical—isn't that about what you would expect in the product of the oldest, and largest chain making plant in the country?

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"The Automobile with a Reputation Behind It."

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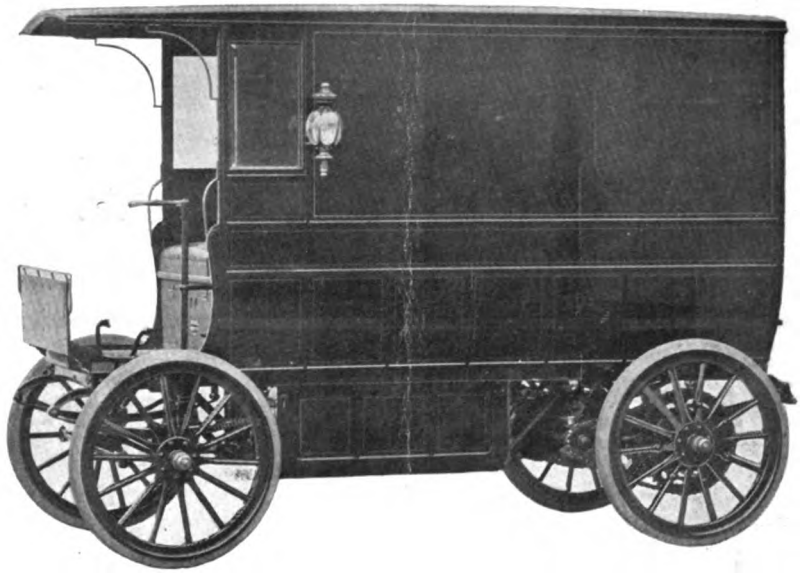

MODEL 2030—ELECTRIC DELIVERY WAGON, PANEL SIDES

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We offer automobile wagons and trucks for all classes of service, and furnish them in sizes ranging from 500 pounds capacity to 5 tons capacity. Bodies can be supplied of any special dimensions, as specified by customer.

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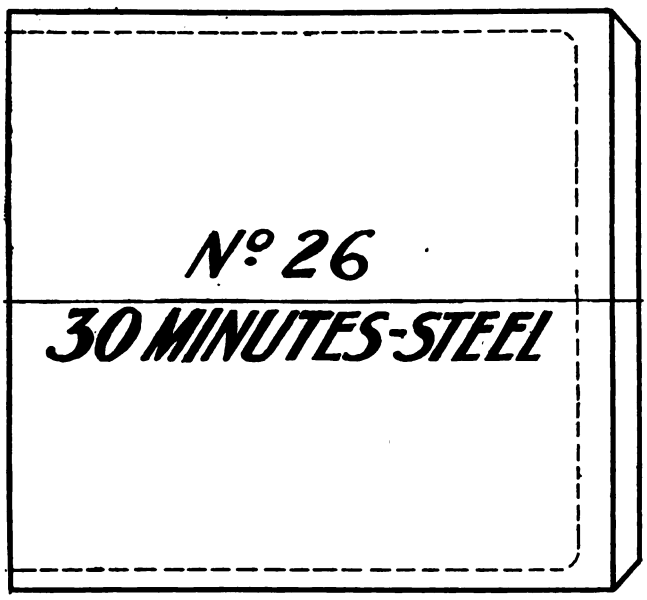

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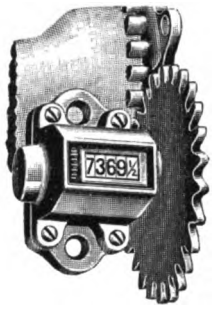

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The loads to be supported, not less than the inequalities of the road surface, make it imperative that nothing but the very best material be employed in their construction.

But even the very best timber will not balance faulty design or careless manufacture.

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"IMPERIAL" manufacturing methods, joined to "IMPERIAL" second growth hickory, furnishes as good insurance as power wagon users can get.

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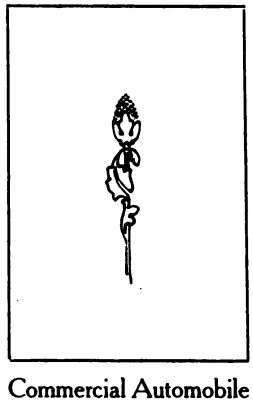

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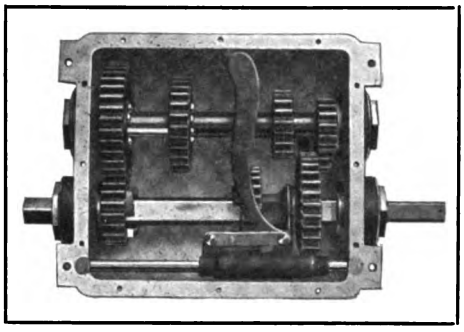

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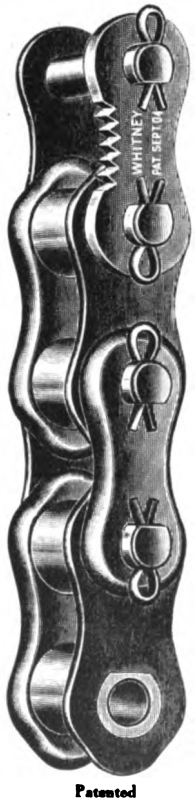

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A Light Convertible Delivery Wagon
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Simple to operate.
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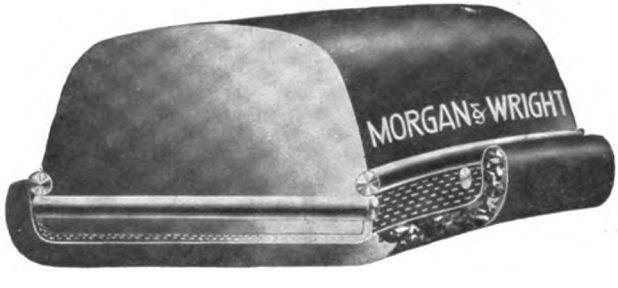

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